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SAN FRANCISCO WASTEWATER PROGRAM

THE CITY AND COUNTY OF SAN FRANCISCO

Bayside Wet Weather Facilities

Revised Overflow Control Study

May 1979

SAN FRANCISCO WASTEWATER PROGRAM

Office of Special Projects

May 15, 1979

Regional Water Quality
Control Board
1111 Jackson Street
Oakland, CA 94607

BAYSIDE WET WEATHER FACILITIES
REVISED OVERFLOW FREQUENCY

Ladies and Gentlemen:

Last November the City and County of San Francisco requested, and the Regional Water Quality Control Board granted, a revised overflow frequency level of four per year for the Northshore Area of the City. Subsequent to receiving State Water Resources Control Board approval, the two tunnel contracts immediately affected, under Ft. Mason and North Point St., were advertised and bids are due in May and June 1979. This completes the Northshore transport system.

In January 1979, the Regional Board granted the City's petition for a revised overflow frequency level for the Westside Zone to allow an average of eight wet weather combined sewage overflows per year. Based on this approval, the City filed a permit application for its scaled-down Westside projects with the California Coastal Commission and expects a decision early in June.

The purpose of this letter is to petition the Regional Board to establish the level of overflow frequency for the balance of the City, namely, the remainder of the North Point Zone and all of the Southeast Zone, known as the Bayside Facilities (see Plate 1 attached). Currently, four overflows per year are permitted for the outfalls in Channel Basin and two outfalls at Islais Creek. The Regional Board has not established a frequency level for the three remaining outfalls in Islais Creek, the three in India Basin, and the four outfalls south of Hunter's Point.

Field studies were undertaken to learn more about the effects of overflows on Bay waters and cost-benefit analyses to establish the appropriate level of control for the Bayside Facilities have been completed by the City in accordance with Regional Board mandates and EPA funding guidelines.

Analysis of additional data collected for the Northshore Area leads us to conclude that the amended overflow frequency of four per year established at the November 1978 RWQCB hearing is reasonable and we are not exercising the privilege granted us by the Regional Board to petition for a further relaxation in this area.

The City is petitioning the Regional Board to allow an average of eight wet-weather combined sewage overflows per year for the entire Bayside Facilities based on the analyses of costs and benefits to be derived and the results of the field studies. An acceptable alternative would be approval of an average of one overflow per year south of Hunter's Point, where there is recreational shellfishing now and potential for commercial shellfishing, and an average of ten overflows per year in the maritime area north of Hunter's Point.

The City is also petitioning the Regional Board to grant exceptions to NPDES requirements, based on recommendations of the Basin Plan, for 1) an initial dilution ratio of 10:1 and 2) for removal of outfall locations from dead-end sloughs and channels. Costs of implementation are tremendous and benefits marginal in both cases.

We are pleased to report that a consultant for the Bayside Facilities Plan has been selected and will begin work in July. A decision on the RWQCB permits is required in order that the consultant may proceed with planning of the remaining facilities.

Because of large increases in the sewer service charge, the citizens of San Francisco are demanding that water quality be improved at a substantially lower cost than is required to meet present permits. The 1977 amendment to the Federal Clean Water Act parallels citizen concern on this point and underscores the need to consider cost effectiveness of wastewater plans.

Detailed information relevant to a decision on these matters is included in the <u>Revised Overflow Control Study, Bayside Wet Weather Facilities</u>, submitted herewith. For your convenience, the following is a brief summary of the findings of this study:

Affected Area

Plate 1 attached depicts the subject area of this report, the Bayside (Southeast Zone and the remainder of the North Point Zone).

Percentage Wastewater Treated

Plate 2 summarizes for the Bayside the volume of wastewater generated and percentage treated at various overflow levels. You will note that for eight overflows, 99.6% of the sanitary sewage and 90% of urban runoff would be treated. For the 1 and 10 overflows alternative, the percentages would change only slightly.

Cost/Benefit Analysis

Plate 3 depicts graphically the associated capital costs for various annual overflows and annual volumes. These clearly demonstrate a "knee of the curve" effect at the eight overflow level.

Assuming a present requirement of four overflows for the entire Bayside, Plate 4 shows a saving of $76 million in capital costs (equivalent to $6 million annual costs) could be realized with only a slight reduction in benefits if eight overflows are permitted.

Comparison of 8/8 and 1/10 Overflow Alternatives

The 8/8 overflow alternative costs slightly less, would produce slightly less emissions, and would be simpler to operate compared with the 1/10 alternative. The latter (one overflow south of Hunter's Point, 10 overflows north of Hunter's Point) would increase capital costs by $5 million over the preferred 8/8 alternative; annual costs would increase by about $400,000. A higher degree of protection would be afforded recreational shellfishers but the additional cost to achieve this would be an estimated $3,000 per day per shellfisherman. Moreover, the impact on commercial shellfishing may be nil because overflows are only a part of the problem. There would continue to be contamination from largely uncontrollable sources of urban runoff and major delta outflow. Finally, while the Candlestick Point State Recreational Area is planned for development over the next twenty years, no cost-benefit estimates are possible because the extent of winter water-contact recreation cannot be estimated.

Basin Plan Recommendations for 10:1 Dilution Ratio

The Basin Plan recommends that all discharges to the Bay achieve an instantaneous 10:1 dilution, i.e., a mixture of 10 parts receiving water to one part effluent immediately outside the discharge pipe. This dilution level normally is achieved some distance away from the outfall structure and would require the outfalls to be greatly extended and also submerged to avoid conflict with maritime activity. The costs and problems of implementing this recommendation are very great. China Basin, for example, would require construction of the world's largest sewage outfall in terms of hydraulic capacity and the cost would be at least $40 million in current dollars. Even so, complete elimination of discharges with less than 10:1 dilution would not be assured. On a smaller scale, the same problem would exist at the other outfalls. In addition, submerging the effluent field may have a greater impact on organisms which live on the bottom, such as crabs and shrimp. Finally, the likely outcome of this effort would be to disperse the effluent to the South Bay, already the most sensitive area of San Francisco Bay in terms of water quality.

Basin Plan Recommendations Regarding Removal of Discharges from Dead-end Sloughs and Channels

There would be little relation between the cost of altering the location of outfalls in these areas and improved water quality because the major sources of contamination are other, uncontrollable, points. If required and an agreement can be reached with the California State Park and Recreational Department for an acceptable location for the Yosemite outfall at a nominal cost, its relocation could be accomplished.

Essentially, if the Basin Plan recommendations above were adopted, there would be no reduction in the total amount of pollutants discharged. In fact, large amounts of money would be spent in a maritime area where the water will always be of marginal quality merely to move pollutants about.

Mitigation Measures

Aesthetic pollution of the Bayside would be reduced at least 84% with the reduction from 46 to 8 overflows per year. In addition, the City will install baffling devices in the overflow structures to further reduce floatable emissions and to mitigate their adverse impacts on recreational use of Bay waters.

Finally, an expanded program of posting shellfish beds during periods of unacceptable water quality has been initiated. The City will also work with the California Department of Parks and Recreation to develop a mutually acceptable beach posting program for the Candlestick Point State Recreational Area.

Thank you for your consideration and favorable action on the City petition.

Very truly yours,

Albert J. Perini
Director of Special Projects

cc: A.O. Friedland
Lou Vagadori
Louise Stoll
Tom Landers
Harold Coffee
Dave Jones

DRAINAGE DISTRICTS

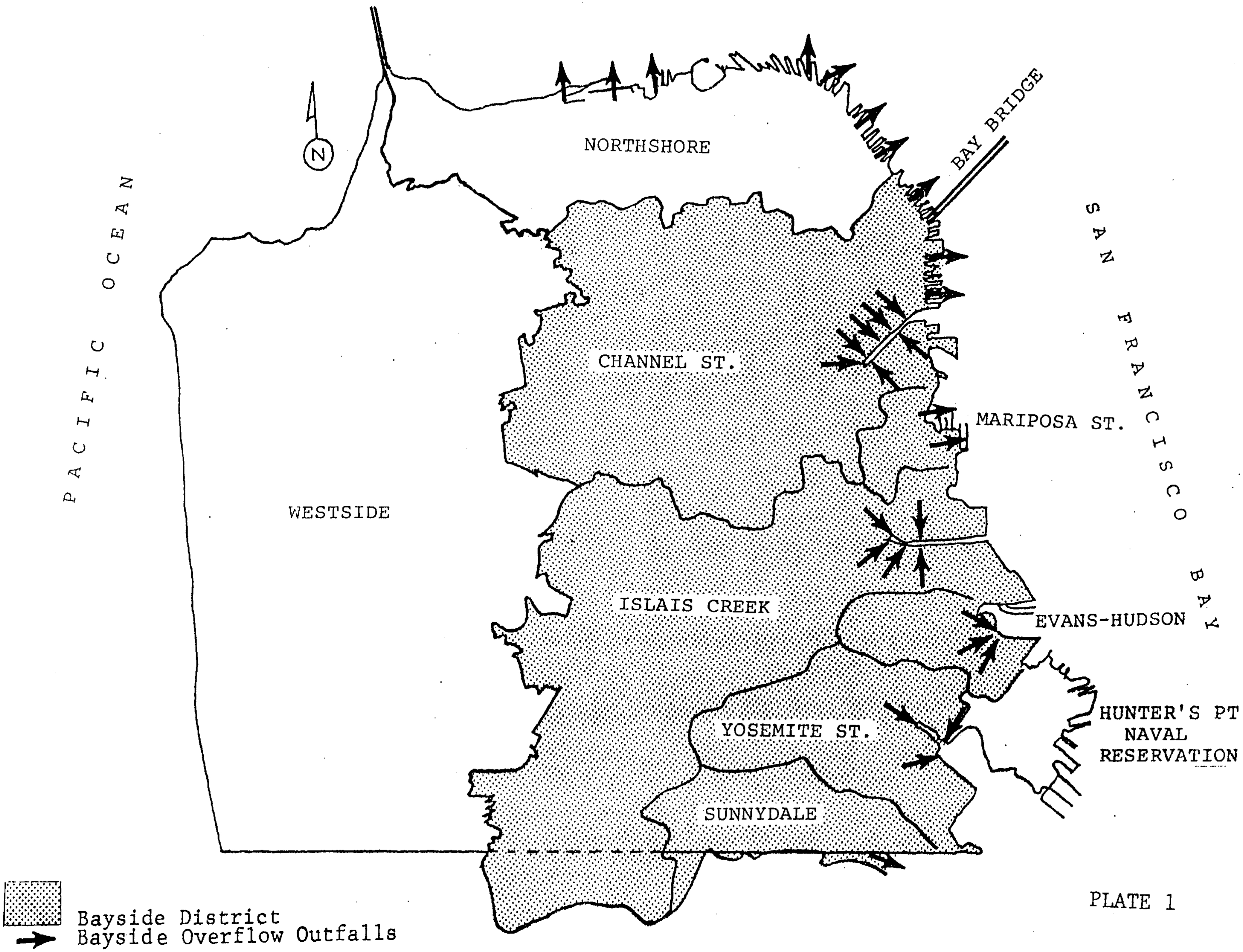


PLATE 1

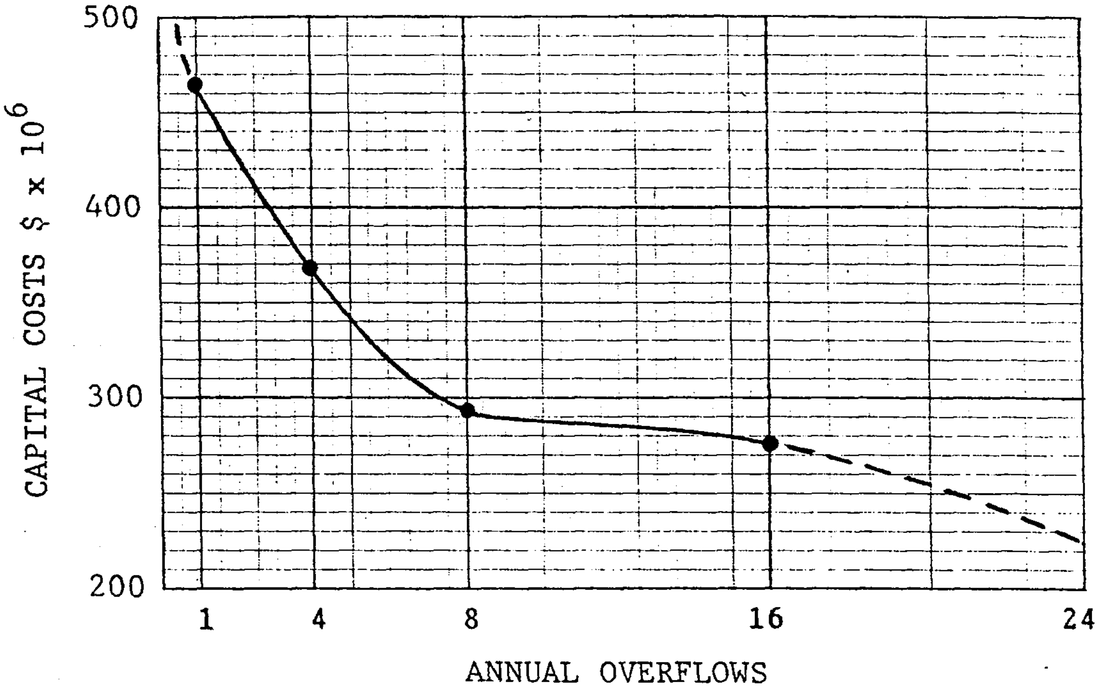
BAYSIDE ZONE

WASTEWATER GENERATED AND PERCENTAGE TREATED

	Generated (Mill. Gal./Yr)	Percentage Treated				
		Existing	16 O'flows	8 O'flows	4 O'flows	1 O'flows
Sanitary	22,280	95.56	98.97	99.64	99.83	99.96
Urban Runoff	5,270	38.7	75.7	89.87	95.16	98.67
Total Wastewater	27,550	84.68	94.52	97.77	98.94	99.71

PLATE 2

BAYSIDE COSTS VERSUS
OVERFLOW FREQUENCY



BAYSIDE OVERFLOW COSTS
VERSUS OVERFLOW VOLUMES

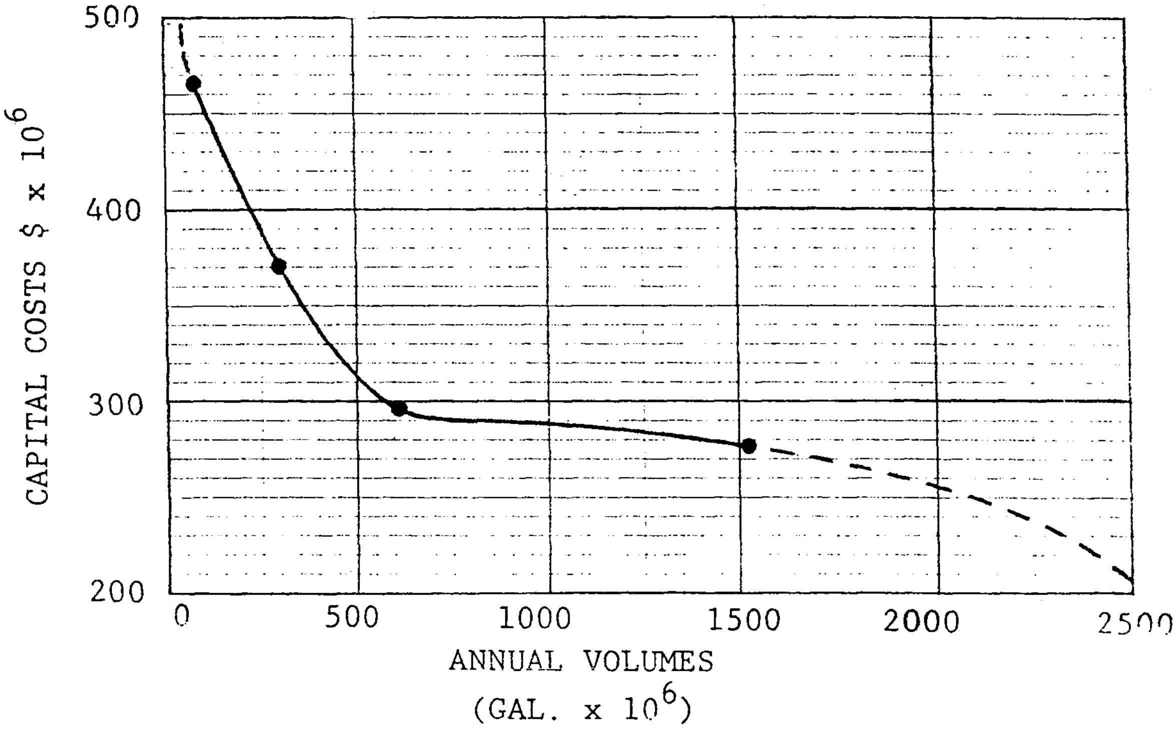


PLATE 3

SUMMARY COST-BENEFIT COMPARISONS

# OF OVERFLOWS		CAPITAL COSTS $\$ \times 10^6$	HOURS OF OVERFLOW	BENEFITS (% REDUCTION FROM EXISTING)*			
NORTH OF HUNTERS POINT	SOUTH OF HUNTERS POINT			O'FLOW VOLUME	TOTAL HEAVY METALS***	DAYS WITH MPN 1000**	SHELLFISH QUARANTINE DAYS**
8	8	293	92	85	85	77	53
4	4	369	96	93	93	88	70
10	1	298	88/99	83	83	97	91

*Percentage reduction in pollutants (e.g. BOD_5 lead etc.) will approximate the percentage reduction in volume

**South of Hunters Point only

***Includes cadmium, chromium, copper, mercury, lead and zinc.

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REVISED OVERFLOW CONTROL STUDY

SECTION 1

PURPOSE AND ORGANIZATION OF STUDY

The purposes of this study are to: (1) Respond to the Basin Plan recommendations and NPDES requirements for "a revised benefit-cost analysis", including the investigation of measures such as outfall extensions, screening, and disinfection to reduce the adverse impacts of overflows, (2) Respond to citizens' concerns about the high cost of the wet-weather overflow control facilities relative to the benefits derived, (3) Respond to Environmental Protection Agency (EPA) policy and funding guidelines requiring cost-benefit evaluations of various levels of combined sewer overflow (CSO) control.

The City-wide overflow control study is divided into three reports in order to avoid excessive delays in the scheduled advertising dates for Westside and Northshore projects, and because of the need for additional field studies to address the potential for localized problems in pH and dissolved oxygen levels in three confined bodies of water south of the Bay Bridge.

The Abstract Report for the Northshore Outfalls Consolidation was submitted to the Regional Water Quality Control Board (RWQCB) in November 1978. At their November hearing the RWQCB acted favorably on the City's request for a relaxation from the specified one overflow per year requirement to a frequency of four overflows per year, with the understanding that the City could at a future date petition for a further relaxation to eight overflows per year. This would be contingent on the City providing additional data demonstrating that the adverse effects of eight overflows were not substantially worse than the effects of the four overflows, as described in the City's November report.

Analysis of additional data collected for the Northshore Area leads us to conclude that the amended overflow frequency of four per year is reasonable and we are not requesting a reconsideration of that action.

The City submitted the Overflow Control Study Abstract Report for the Westside of the City in December 1978 and the City's request for a relaxation to eight overflows per year for this zone was granted at the January RWQCB hearing.

This report will examine the costs and benefits of various levels of overflow control, i.e. number of permitted overflows for the Bayside Facilities (south of Market Street - Southeast Zone - see Figure I-1).

Basin Plan Recommendations & NPDES Requirements For This Study

The 1975 Basin Plan discusses the "...difficult problem of wet weather control" presented by the combined sewer system in San Francisco, acknowledges the fact that any solution would be "inherently costly", and concludes with the recommendation "that a revised benefit-cost analysis be performed by the City for each zone, especially those areas which incur high recreation usage".

In March 1976 the RWQCB issued NPDES Permits CA 0038415 and CA 0038407 for the wet-weather diversion structures in the Richmond-Sunset (Westside) and North Point sewerage zones respectively. Both permits contain identical language requiring the City to undertake the revised-benefit-cost analysis recommended in the Basin Plan; and both permits contain the clause "that the Regional Board will consider amendment of this Order to further reduce frequency of discharge, after review of the information requested in Provision B-4 above" (Reference to B-4 above is to the revised benefit-cost analysis). However, at a meeting early in 1978 the RWQCB staff indicated to City offocials that they would be amenable to recommending a relaxation of the permitted overflow frequencies if justified by the City's benefit-cost analysis.

Both permits mandate the Basin Plan recommendations against discharges into dead-end sloughs or discharges with less than 10:1 initial dilution, and both permits also contain a clause to the effect that they will consider exceptions to these requirements.

EPA Policy & Funding Guidelines for Combined Sewer Overflows (CSO) Projects

The 1975 policy statement on implementing PL-92-500 (See Appendix D) recognizes the following factors relating to combined sewer overflows:

- The lack of national information on the water quality effects of combined sewer overflows.
- The characteristically uneven pollutant load of overflows during the course of a rainfall event.
- The radical variations in stormwater flow and frequency of occurrence in various basins and regions.
- The lack of a generally recognized acceptable level of treatment for overflows.

Based on these findings, EPA promulgated the following strategy for implementing Federal law:

- Combined sewer overflows are excluded from the definition of publicly owned treatment works which must comply with the Federal effluent standards of secondary treatment by 1977. (Note - 1977 Amendments extended this deadline to 1983).

- Separate uniform effluent standards for combined overflows will not be promulgated.

- Correction of overflow problems will be defined in terms of meeting the applicable water quality standards of 1977 (Basin Plan receiving water standards) and the fishable/ swimmable standards of 1983 (standards necessary to meet the Federal law goal that all the nation's surface waters be of suitable quality to support aquatic life and water-contact recreation by the year 1983).

- The concept of "meeting water quality standards" will be further defined in guidance by EPA.

- Where overflow conditions have been studied and overflow correction needs are known, treatment of overflows can be given comparable eligibility with treatment plant construction in terms of access to Federal funding.

- States are at liberty to handle acute overflow problems on a case-by-case basis but will not be required to provide correction of all problems by 1977.

In December 1975 EPA issued Program Guidance Memorandum - 61 (subsequently reissued as PRM 75 - 34) containing their policy on funding combined sewer overflow projects. This Memorandum (see Appendix D) requires that planning for CSO projects consider "The benefits to the receiving waters of a range of levels of pollution control during wet-weather conditions" and further requires as a condition for project approval that the final alternative selected satisfy the criterion that "The marginal costs are not substantial compared to the marginal benefits."

Public Concerns

There is considerable public concern about the tremendous costs of the facilities needed to achieve compliance with the present discharge requirements. The City's 12½% share of the construction costs and the entirety of the operation and maintenance costs will be financed by the sewer service charge. This charge now averages $6 per month for a typical single-family residence and is expected to increase to $15 per month upon completion of the Master Plan facilities (assuming continuance of the same cost-proration formula). Costs for the wet-weather facilities will amount to 60% to 70% (depending on overflow frequency) of the total equivalent annual costs of the Master Plan facilities.

DRAINAGE DISTRICTS

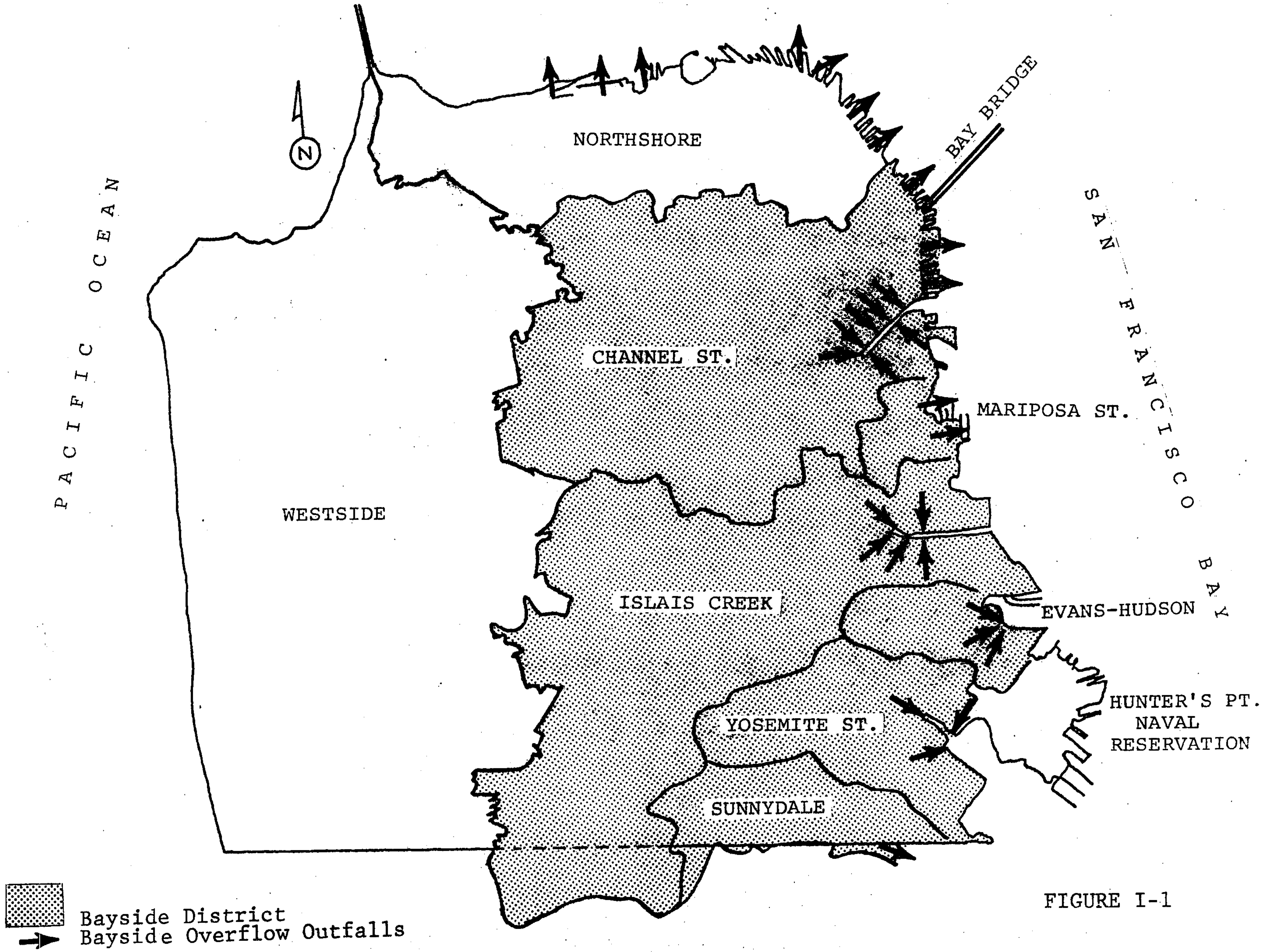


FIGURE I-1

SECTION II

BACKGROUND

Most urban sewer systems built in the 19th century and the early years of this century were combined systems (i.e., a single network of pipes for sanitary sewage and urban drainage). Nationwide there are approximately 1300 communities with some or all of their sewer system combined. Most of these communities are located in the northeast and upper mid-west portions of the country. Older far western cities with significant areas of combined sewers include San Francisco, Sacramento, Seattle, Spokane, Portland, and Salem.

Existing Conditions in San Francisco

Because of limited treatment capacity and a lack of storage inherent in the existing system, overflows occur whenever rainfall exceeds 0.02" per hour (a heavy drizzle). These overflows occur 82 times a year (Citywide average). The excess flow is discharged through 39 shoreline overflow structures distributed around the periphery of the City. These structures range in size from 18" diameter pipes to quadruple 8'3" x 9'6" box culverts. The composition of these overflows can range from approximately 2 parts sanitary flow to one part runoff to greater than 50 parts runoff to one part sanitary and the duration of overflows can range from a few minutes to a few days. California Administrative Code standards for receiving water bacteriological quality are exceeded approximately 170 days a year (Citywide average), due to sewer overflows.

Under the existing condition of 82 overflows per year (Citywide), approximately 97.5% of the City's sanitary flow and roughly 30% of the urban runoff receives primary treatment and disinfection.

Master Plan Recommendations

Studies for the control of wet-weather overflows were initiated in 1967. In 1971 the City published the comprehensive Master Plan containing recommendations for the construction of a series of upstream retention basins, transport-storage tunnels, and a single wet-weather treatment plant, all for the purpose of limiting wet-weather overflows to a frequency of eight per year. Subsequent revision to the Master Plan deleted a majority of the upstream retention basins in favor of shoreline outfall consolidation structures.

Basin Plan Recommendation For Overflow Frequency

The Basin Plan recommended that wet-weather overflow limitations be based on beneficial uses of the affected shoreline and specifically recommended overflow frequencies of 0.2 overflows per year to eight overflows per year. The Basin Plan also recommended that wet-weather overflows receive coarse screening to remove large visible floatable material, be discharged through outfalls designed to achieve a 10:1 initial dilution, be removed from dead-end slough and channels, and be discharged away from beaches and marinas. However, earlier in their discussion of wet-weather overflow problems, the authors stated that: "The approach presented is conceptual and <u>should not be interpreted as rigid numerical objectives</u>. The specified control levels are based on available information <u>and should be evaluated by the Regional Board and other agencies prior to the designation of such levels for each area."</u> (emphasis ours)

<u>Present NPDES Overflow Frequency Requirements</u>

In 1976 the RWQCB issued NPDES permits for the wet-weather diversion structures. Permit No. CA 0038415 mandated the more stringent of the two Basin Plan recommended frequencies for the Westside portion, namely one overflow per year. This frequency was changed to eight per year at the RWQCB hearing in January 1979.

NPDES Permit No. CA 0038407 incorporated in RWQCB Order 76-24 for the North Point Sewerage Zone mandated one overflow per year for outfalls 9 through 17 and 4 overflows per year for outfalls 18 through 28. RWQCB Order 78-102 dated November 21, 1978 amended order 76-24 to change the overflow frequency for outfalls 9-17 from one to four per year.

NPDES Permit No. CA 0038423, for the Southeast Zone, established an overflow frequency of 4 per year for certain structures discharging into Islais Creek. No overflow frequencies are set for the balance of this zone, apparently due to uncertainties as to the nature and extent of the shellfish beds located in this zone.

The Bayside Facilities covered by this report include outfalls 18-28 of the North Point permit and all outfalls covered under the Southeast permit. These structures are tabulated in Table II-1.

TABLE II-1

BAYSIDE OVERFLOW OUTFALL STRUCTURES

OUTFALL Number	OUTFALL Name	OUTFALL SIZE Width x Height or Diameter	PEAK FLOW During 5 yr. Storm[b] -MGD[c]	DISCHARGE LOCATION
		North Point Zone		
18	Howard St.	7'	175	Pier 14
19	Brannan St.	7'6"x6'	129	Pier 32
20	Townsend St.	2'x3'	17	Pier 38
21	Berry St.	1'3"	Abandoned	Pier 42
22	Third St.	2'6"x3'9"	19	China Basin
23	Fourth St. No.	6'6"	61	China Basin
24	Fifth St.	9'x7'	273	China Basin
25	Sixth St. No.	6'	149	China Basin
26	Seventh St.	4-(9'6"x8'3")	1750	China Basin
27	Sixth St. So.	3'6"x5'3"	40	China Basin
28	Fourth St. So.	2'6"x3'9"	13	China Basin
		South East Zone		
29	Mariposa St.	6'	193	Central Basin
30	Twentieth St.	2'	Negl.	Central Basin
31	No. Third St.	3.5x5.25'	84	Islais Creek
32	Marin St.	10'x8'	710	Islais Creek
33	Selby St.	3[a]-(10'x7.5')	1740	Islais Creek
34	Rankin St.	5'	52	Islais Creek
35	So. Third St.	4.5'	65	Islais Creek
36	Mendell Ave.	4'	Abandoned	India Basin
37	Evans Ave.	6'	102	India Basin
38	Hudson St.	2.5'	55	India Basin
39	Griffith St. N.	1.75'	16	India Basin
40	Griffith St. S.	5.5'	150	South Basin
41	Yosemite Ave.	9'x7.25' & 11.5'x6.5'	590	South Basin
42	Fitch St.	6.75'	102	South Basin
43	Sunnyvale Ave.	6.5'	334	Candlestick C[illegible]ve

(a) Number of barrels

(b) These flows result for a short period from a peak rainfall intensity of 1.5 inches per hour.

(c) Million Gallons per Day.

SECTION III

CITY-WIDE CONSIDERATIONS

The planning for control of combined sewer overflows is a two-tiered effort. A city-wide evaluation is required, which is nearing completion, to determine the most cost-effective wet-weather flow management options (e.g. single wet-weather plant versus several wet-weather plants) to achieve a particular level of wet-weather control, and to evaluate the potential for any region-wide or long-term adverse effect of the total wet-weather overflow discharges. Once the City-wide level of effort and wet-weather flow management scheme is established, a zone-by-zone cost-benefit analysis can be made to maximize the benefits that would be derived from the overall expenditure levels. As part of the planning for the Southwest Treatment Plant, tasks were included to perform the City-wide element of the required revised cost-benefit analysis. The analysis confirms the cost-effectiveness of the original Master Plan concept, i.e. a single wet-weather plant in the Southwest portion of the City, and the bulk of the Master Plan flow routing concepts. Cost and mass emission data developed during this analysis will serve as the basis for the following discussion of the City-wide cost-benefit considerations.

City-wide Cost-Benefit Considerations

Traditionally, cost-benefit analysis has consisted of plotting a cost-benefit curve with the expectation that a pronounced "knee of curve" will develop to suggest the optimal level of effort. This approach is difficult to apply to the City-wide overflow level for two reasons: (1) In this case, as in most real-world cases, no pronounced "knee of curve" appears, rather, the curves have a gradual curvature through the range of frequencies under consideration, and (2) In the cost-benefit analysis, the benefits are being measured indirectly, in effect, decreased emissions are being measured, not increases in the beneficial uses and productivity of the receiving waters.

City-wide wet-weather costs have been compared with the expected benefits, i.e. reduction in pollutants discharged for City-wide overflow control frequencies of 16, 8, 4 and 1 overflows per year and are plotted on Figure III-1. These curves confirm the classic "law of diminishing returns" concept, that is, more stringent levels of overflow control require a greater number of dollars be expended to remove incrementally less pollutants.

City-wide Mass Emissions in Overflows

Table III-1 provides a comparison of mass emissions from San Francisco's overflows to total mass emissions into the Bay and Gulf of the Farollones. Under the present conditions, overflows contribute less than 8% of the total pollutant emissions.

COMPARISON OF COMBINED SEWER OVERFLOW LOADINGS WITH TOTAL BASIN LOADINGS
(Excludes Direct Industrial Discharges & certain non-point sources)

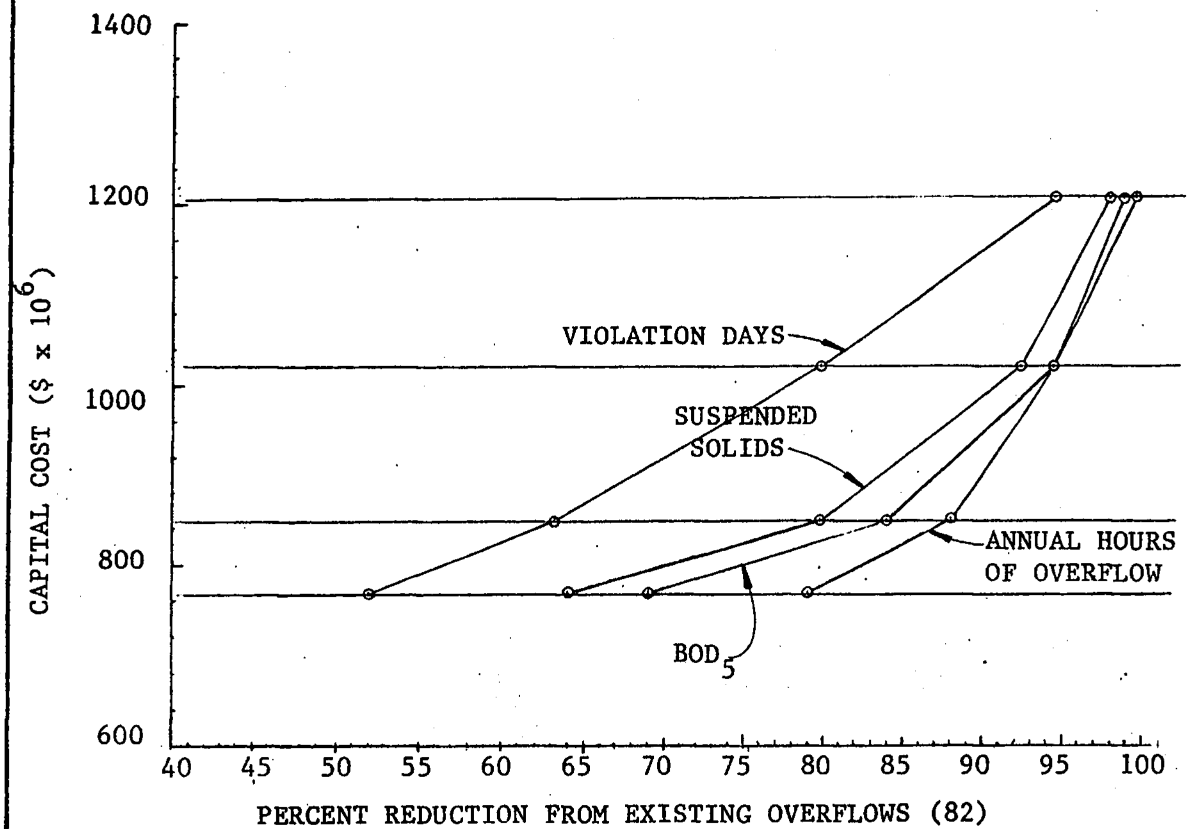
LOADING 10^6 lbs/year

SOURCE	PARAMETER			
	TSS	BOD_5	TOTAL N	TOTAL HEAVY METALS[3]
Delta Outflow[1]	3250	40	28	5
Treated Effluents[2]	36	27	53	0.5[10]
Urban Runoff[4]	1060[8]	27	7	2.5
Aerial Fallout[5]	–	–	2	0.7
S.F. Overflows[6][7]	16[9]	7.7	0.25	0.16
TOTAL	4362	101.7	90	8.86
Overflow % of Total Loadings	0.4%	7.6%	0.3%	1.8%

(1) Source ABAG (1978) winter values only for Delta Outfall
(2) Assumes 600 MGD & Secondary Treatment
(3) Includes Cd, Cr, Cu, Pb, Hg, Ni, & Zn
(4) Source Basin Plan Table 15-13 excluding S.F.
(5) Source Basin Plan Table 15-23.
(6) Source Basin Plan Table 15-13 (except TSS & BOD_5)
(7) Citywide-existing conditions
(8) Source ABAG (1978) less S.F. overflows
(9) Based on 7.7×10^9 gal/year @250 mg/average conc.
(10) Assumes 300 ug/1 in secondary effluent

TABLE III-1

CITY WIDE COST-BENEFIT ANALYSIS



NUMBER OF OVERFLOWS	WET WEATHER CITY-WIDE COST ($x10^6) (4) CAPITAL (1)	ANNUAL (2) (3)
1	1206	91
4	1024 [a]	78 [a]
8	848	64
16	763	61

a) updated costs to 4/79

(1) Includes cost of projects under construction. Construction costs based on (ENR 3200) Dec. '77. Sludge and reclamation costs not included. Sales and purchase of treatment plant land included.
(2) Annual cost is equal to equivalent capital cost plus O&M. Equivalent capital cost based bond payoff of 20 years at 6 5/8% interest, adjusted to (ENR 3200) Dec. '77.
(3) O&M based on 20-year period, 8%/yr. inflation and 6 5/8%/yr. interest, adjusted to (ENR 3200).
(4) Costs updated 4/79.

Fig. III-I

SECTION IV

CHARACTERISTICS OF COMBINED SEWER OVERFLOWS

Data Sources

The first study of the properties of San Francisco's combined sewer overflows was undertaken during the 1966-1967 hydrological year by Engineering Science Inc. (ESI, 1967). Continuous sampling of the overflows at Selby Street (8-storms) and at Laguna Street (2-storms) was done for total suspended solids (TSS), volatile suspended solids (VSS), 5-day biological oxygen demand (BOD_5), chemical oxygen demand (COD), Ammonia nitrogen, grease, particulate floatables, settleable solids (30-minute test), total and fecal coliforms. No sampling for heavy metals or chlorinated hydrocarbons was undertaken during this early survey.

Metcalf & Eddy, as part of their studies for the Southwest Treatment Plant, sampled the influents at all three treatment plants during several storms in late 1977 and three storms during 1979. Grab and composite samples were taken for TSS, VSS, BOD_5 and selected heavy metals.

At the request of the EPA, the City retained Brown & Caldwell to collect single grab samples at six overflow points during three storms in 1979. Analysis was made for lead, mercury, cadmium, chlorinated hydrocarbons, coliforms (total and fecal) and fish survivals (96 hour static bioassay). (see Appendix B)

In addition to the above special studies, the City routinely monitors wet-weather overflows and receiving waters for coliform, toxicity, and settleable solids (ml/l/hour). Subjective observations are made for appearance (color and turbidity), sewage solids and area of impacts. Samples are collected typically during the first two hours of an overflow. However, only a few overflow points are visited in each zone during storms and sampling is not done if the overflows occur at night or on the weekend. The most useful data from this program is the receiving water coliform data and the overflow fish bioassay data.

Treatment plant influent data for suspended solids and BOD_5 is available and has been analysed by Metcalf & Eddy. This data is based on 24-hour composite samples which in virtually all cases include some periods of dry-weather flow only, and are therefore of limited use in evaluating wet-weather flow characteristics. This data does show generally lower wet-weather influent concentrations as the rainy season progresses.

Analysis of Data

All of the available data sources are limited with respect to the parameters evaluated, locations of sampling, and extent of sampling. In addition, concentration of some constituents can vary by almost two orders of magnitude through the course of a storm and storm average values can vary depending on the size of the storm and time of the year. The 1967 ESI data is heavily influenced by one very large storm (3.9" of rainfall) occurring late in the season while the 1977 M & E data are from relatively small, early season storms. The 1979 data is from small to moderate size mid-season storms. Flow data is incomplete for some 1977 and 1979 sampling;therefore flow weighted averages cannot be computed. For these reasons the average values shown in the Table IV-1 are indicated as estimates. These values are generally in good agreement with Sacramento and Seattle data for combined sewer overflows and urban runoff (Table IV-3).

A notable exception is the high chromium level which, we believe, is the result of industrial discharges in the Southeast zone. Chromium levels were observed to jump dramatically during the sampling of a storm occuring on Tuesday, February 13, 1979. Prior to 8:00 a.m., chromium levels were running between 115 and 215 ug/1 (6 samples.) The three samples taken after 8:00 a.m. had chromium levels of between 2750 and 4180 ug/1, 70% of which was attributable to the dissolved or colloidal phase. Data from this storm has been forwarded to the City's Industrial Waste Division in order to determine the sources and take corrective action.

For comparison purposes, the constituents of dry-weather flows have been tabulated. Appendix C provides influent data gathered as part of the 1973 CH2M-Hill pilot plant studies and includes data on such rarely monitored metals as thallium, uranium and vanadium. Table IV-3 is the effluent data for 1965 to 1978 compiled from periodic sampling done as part of the City's Self-Monitoring Program.

Toxicity of Overflows

The potential for acute toxicity to marine organisms is measured by standard 96-hour static bioassays using the three-spine stickleback as the test organisms. As part of the Self-Monitoring Program, 92 bioassays of overflows from the Northpoint and Southeast Districts were run using the geometrically scaled dilutions contained in Standard Methods. In addition 15 bioassays were run in undiluted overflow only as part of 1979 Supplementary Monitoring Program. Table IV-4 is a tabulation of the mortalities at the various dilutions Table IV-5 tabulates the percentage of tests with the indicated survival rates in the undiluted overflow. An examination of those results indicate:

- The Mariposa and Evans-Hudson Sub-basins have the most toxic overflows. These two small sub-basins combined contribute 2% of the Bayside wet-weather flows.

- The overall toxicity of Bayside overflows meets the RWQCB median standard of 90% survival for shallow water discharges but fail to meet the 90 percentile standards for either deep water or shallow water discharges. These standards are for continuous discharge of treated effluents.

- The toxicity of Bayside overflow compares favorably with the toxicity of the dechlorinated, chemically-assisted primary effluents from the City's two Bayside Treatment Plants.
- Mortality at overflow concentrations of 32% or less (approximately 2:1 dilution) is minimal.

Overflows Volumes and Mass Emissions

Table IV-6 provides estimates of overflow volumes, durations, and mass emissions for the existing condition of 46 overflows per year and control levels of 16, 8, 4 and 1 overflows per year. Data is provided for the average year as well as data for the wettest and the dryest years within the past 70 years. Mass emission estimates are based on the conservative assumption that the unit concentrations of overflows under controlled conditions will remain unchanged. Table IV-9 provides the distribution of flows amongst the various subbasins within Bayside.

Quality of Future Overflows

The concentrations of those parameters that are primarily associated with sanitary sewage will be reduced in controlled overflows due to the fact the future overflows will contain a lesser percentage of sanitary sewage than existing overflows. Of particular importance is ammonia, as this substance has been implicated as a principal cause of death in acute bioassay tests (Basin Plan - 1975). Ammonia concentration in Bayside sanitary sewage can range from about 10 mg/1 to 40 mg/1 with an average of about 14 m/gl (CH2M-Hill - 1973) while ammonia concentrations in urban runoff are typically 1 mg/1 or less (Seattle - 1979). Under existing conditions Bayside overflows have an average of 23% sanitary sewage and can under 'worst case' conditions (minimum rainfall needed to generate an overflow, coupled with the peak hours of sanitary flow) consist of up to two-thirds sanitary sewage at certain overflow points. The peak ammonia concentration of 23.8 mg/l obtained during the 1967 ESI study is consistent with this 'worst-case' blend and is several times the 8.0 mg/l value used in the Ocean Plan as an instantaneous receiving water maximum. Assuming the same "worst case" conditions, the estimated peak ammonia concentration under controlled conditions would be about 10 mg/l, a value that is slightly over the receiving water limit.

The concentration of heavy metals in controlled overflows may be somewhat less than existing concentrations. Heavy metals concentrations in CSO's are comparable to concentrations in urban runoff (Note: Sacramento and Seattle data in Table IV-3.). EPA-sponsored studies of toxic materials in street surface contaminants (EPA 1972, 1973) reported that most of the heavy metals and some pesticides in street surface contaminants are associated with particulate material of greater than 100 micron size (see Table IV - 7 and Figure IV-1). A survey of Bayside sewer deposits found that the dominant portion of the existing deposits were in the 125 to 600 micron size range (Table IV-8). Under existing conditions, much of the deposits are resuspended and swept out through the overflow structure during the next major storm. The proposed transport/storage structures will be specifically designed to maximize capture of settleable material and to convey this material to the treatment plant during post-storm dewatering.

In addition, lead values in future overflows can be expected to decline due to the ever decreasing percentage of vehicles on the road that can legally burn leaded gasoline.

Seasonal Distribution of Overflows

Rainfall in San Francisco is a highly seasonal phenomena with the bulk of the rainfall concentrated in the period between mid-November and mid-March. Expected monthly distribution of overflows (long-term averages) for an 8 overflow control level are as follows:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave #/yr	2	1.3	1	0.3	0.1	nil	nil	nil	0.1	0.4	0.9	1.7
% of total	25	17	13	3.7	1.7	0.4	nil	nil	1.1	5.6	12	21

Percent distribution by month of the year for other control levels is comparable. As noted in the above tables, few overflows will occur during months of peak recreational activities (May through September).

CONSTITUENTS OF
BAYSIDE COMBINED SEWER
OVERFLOWS

Parameter	Unit	Source(s)	Minimum	Maximum	Estimated Average
TSS	mg/l	ESI, CH2M, M & E	14	1436	250**
VSS	mg/l	ESI, M&E	19	612	100
BOD_5	mg/l	ESI, M&E	21	450	120
PO_4	mg/l	ESI	0.2	7.7	0.9
Ammonia-N	mg/l	ESI	0	23.8	4
Grease	mg/l	ESI	0.4	122	13
Total Coli-forms	MPN/100 ml	B&C	$2.4x10^5$	$7.9x10^6$	$2.4x10^6$*
Fecal Coli-forms	MPN/100 ml	B&C	$7x10^4$	$2.4x10^6$	$3.8x10^5$*
Settable Solids	ml/l/30m	ESI	<0.3	145	20
Arsenic	ug/l	M&E	-	<8	-
Cadmium	ug/l	B&C	1	4	1
Chromium	ug/l	M&E	5	4180	350
Copper	ug/l	M&E	50	1340	250
Iron	ug/l	M&E	40	15,500	3400
Lead	ug/l	M&E, B&C	10	1350	300
Mercury	ug/l	B&C	0.1	1.0	0.3
Nickel	ug/l	M&E	50	160	80
Silver	ug/l	M&E	20	<50	-
Zinc	ug/l	M&E	20	1550	560
TICH	ug/l	B&C	-	<2	-

*Median

**A cursory examination of preliminary data from the 1979 CH2M-Hill studies suggests significantly lower average TSS concentration

TABLE IV-1

NORTHPOINT & SOUTHEAST PLANT DRY-WEATHER EFFLUENT DATA FOR TOXIC SUBSTANCES 1975-1978

Parameter	Concentrations Ug/l South East Median	South East 90%-ile	North Point Median	North Point 90%-ile
Arsenic	3	10	4.0	32
Cadmium	10	27	10	18
Chromium	162	700	23	41
Copper	56	122	88	144
Cyanide	45	106	35	82
Lead	90	170	73	120
Mercury	1.0	7.0	0.9	1.3
Nickel	112	438	41	119
Phenols	160	258	41	63
Silver	7	10	15	28
TICH*	0.42	2.7	0.32	1.04
Zinc	356	594	220	434

*Total Identifiable Hydrocarbons Includes:

Aldrin	o'p'DDD	Endosulfan II
alpha BHC	p'p'DDD	Endrin
beta BHC	o'p'DDE	Heptachlor
gamma BHC (Lindane)	p'p'DDE	Methoxychlor
delta BHC	o'p'DDT	Mirex
Captan	p'p'DDT	PCND
alpha Chlordane	Dieldrin	
gamma Chlordane	Endosulfan I	

TABLE IV-2

COMPARISON OF BAYSIDE CSO's WITH OTHER CSO's AND URBAN RUNOFF

AVERAGE CONCENTRATIONS

Parameter	Unit	COMBINED SEWER OVERFLOWS			URBAN RUNOFF	
		Bayside	Sacramento	Seattle	Sacramento*	Seattle
Arsenic	ug/l	<8	2.8	-	2.6	-
Cadmium	ug/l	1	3.6	10	6.5	6
Chromium	ug/l	350	24	90	26	60
Copper	ug/l	250	116	230	42	140
Iron	ug/l	3400	-	-	-	-
Mercury	ug/l	0.3	0.8	10	1.2	0.5
Lead	ug/l	300	300	610	334	300
Nickel	ug/l	80	48	50	27	30
Silver	ug/l	<50	9.3	-	3	-
Zinc	ug/l	500	448	360	258	280
Ammonia-N	mg/l	4	2.8	0.9	-	0.4
TSS	mg/l	250	180±	220	318	99
TSS	mg/l	100	60±	-	184	-
BOD	mg/l	120	60±	60	67	19
Total Coliforms	MPN/100ml	2.4×10^{6}**	8×10^{6}±	2.3×10^{6}	2.5×10^{5}	6.7×10^{5}
Fecal Coliforms	MPN/100ml	3.8×10^{5}**	-	2.5×10^{5}	2×10^{3}	6.4×10^{4}
Fecal Strept.	MPN/100ml	-	-	4.6×10^{4}	6.5×10^{4}	-

*Average of Sump 104 & Sump 111 Data
**Median

TABLE IV-3

RESULTS OF 96-HOUR STICKLEBACK BIOASSAYS

OF BAYSIDE OVERFLOWS

Sub-Basin	N	% Mortality Overflow Concentrations Control	10%	18%	32%	56%	100$	% Samples with Tu 1.5 (median)	% Samples with Tu 2.5 (90 percentile
Northshore	26	0.0	2.0	0.4	0.8	4.2	15.4	100.0	1.0
Channel	9	0.0	0.0	0.0	1.1	0.0	21.1	100.0	0.0
Mariposa	12	0.0	0.8	0.0	0.0	1.7	59.2	100.0	0.0
Islais Creek	18	0.0	0.0	0.6	6.1	7.8	33.3	94.4	5.6
Evans-Hudson	9	0.0	1.1	2.2	15.1	22.2	44.4	77.8	11.1
Yosemite	14	0.0	0.0	0.0	0.7	7.1	30.7	92.8	0.0
Sunnydale	4	0.0	0.0	0.0	0.0	0.0	20.0	100.0	0.0
Overall	92	0.0	0.8	0.4	3.2	6.2	30.5	95.6	2.2
North Point-Dechlorinated Effluent	74	1.8	4.2	3.4	4.9	7.3	38.4	92.5	2.5
Southeast Dechlorinated Effluent	40	1.0	3.0	4.5	6.0	4.8	49.8	95.0	0.0

Table IV - 4

SURVIVAL IN UNDILUTED OVERFLOW

Sub Basin	N	% of Tests with Indicated Survival Rate						
		100%	90%	80%	70%	60 %	50%	< 50%
Northshore	32*	56.2	12.5	9.4	3.1	6.3	3.1	9.4
Channel	9	33.3	33.3	-	-	-	22.2	11.1
Mariposa	12	16.7	-	-	8.3	8.3	-	66.7
Islais Creek	18	33.3	5.6	11.1	11.1	11.1	-	27.8
Evans-Hudson	9	33.3	-	11.1	-	22.2	-	33.3
Yosemite	20*	50.0	15	-	10	5	-	20
Sunnydale	7*	57	14.3	14.3	-	-	14.3	-
OVERALL	107	43.0	11.2	6.5	5.6	7.5	3.7	22.4

* Includes results form 1979 Supplemental Monitoring Program (20 organisms per test in undiluted overflow)

Table IV-5

BAYSIDE

STATISTICAL SUMMARY WET-WEATHER OVERFLOWS

CONTROL LEVELS

Yearly O'flow Totals	Unit	Existing Min	Existing Ave	Existing Max	16 per year Min	16 per year Ave	16 per year Max
No. of Overflows	Event	17	46	77	5	16	32
% Reduction			Base			65	
Hours of Overflow	Hour	157	381	671	15	86	179
% Reduction			Base				
Total Wastewater	$Gal. x 10^6$	1,240	4,220	7,610	185	1,540	3,410
% Reduction			Base			64	
Sanitary Discharge	$Gal. x 10^6$	410	990	1,730	39	230	460
% Reduction			Base			77	
Urban Runoff	$Gal. x 10^6$	830	3,230	5,880	146	1,280	2,950
% Reduction			Base			59	
Composition of Discharge (% Sanitary)	%		23			15	
Days Receiving Wastes (near outfalls) coliform levels exceed:							
(1) 10,000 MPN/100 ml	Days	34	60	97	9	24	45
% Reduction			Base			60	
(2) 1,000 MPN/100 ml	Days	66	104	135	20	45	85
			Base			57	
BOD_5	$lbs. x 10^3$	1,240	4,230	7,620	186	1,550	3,420
% Reduction			Base			63	
Suspended Solids	$lbs. x 10^3$	2,590	8,810	15,900	386	3,210	7,110
% Reduction			Base			64	

Table IV-6

TABLE 60

PERCENT OF HEAVY METALS IN
VARIOUS PARTICLE SIZE RANGES

AVERAGE OF FOUR CITIES: TULSA, BALTIMORE, SAN JOSE II, SEATTLE	< 104 μ	104 to 246 μ	246 to 495 μ	> 495 μ
Zinc	20%	26%	21%	33%
Copper	26	33	15	26
Lead	14	28	35	23
Iron	11	21	21	47
Cadmium	36	52	12	0
Chromium	20	24	17	39
Manganese	16	20	20	44
Nickel	23	17	31	29
Strontium	34	12	15	39

Table IV-7
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Table 1. ESTIMATED SETTLING AND SCOUR VELOCITIES OF PARTICLES AND SIEVE ANALYSIS RESULTS FOR SEDIMENT SAMPLES COLLECTED IN DIVISION STREET SEWER ON DECEMBER 5, 1978.

Barrel No. 1

Sieve size opening, mm	Estimated values		Sample No. 1			Sample No. 2			Sample No. 3			Sample No. 4		
	Settling velocity, cm/s	Scour velocity, ft/s	Weight retained on sieve, gm	Retained on sieve, %	Weight % with size >sieve opening	Weight retained on sieve, gm	Retained on sieve, %	Weight % with size >sieve opening	Weight retained on sieve, gm	Retained on sieve, %	Weight % with size >sieve opening	Weight retained on sieve, gm	Retained on sieve, %	Weight % with size >sieve opening
2	36.58	2.36	2.0	0.8	0.8	0.6	0.35	0.35	4.5	1.86	1.86	0.5	0.32	0.32
1	21.3	1.669	6.0	2.42	3.23	0.8	0.46	0.81	6.7	2.77	4.63	0.8	0.50	0.82
0.850	18.29	1.539	3.2	1.29	4.52	0.5	0.29	1.10	4.0	1.65	6.28	0.9	0.56	1.38
0.600	12.2	1.293	10.3	4.15	8.67	0.8	0.46	1.56	10.3	4.25	10.53	0.4	0.25	1.63
0.250	3.66	0.835	190.6	76.88	85.56	64.6	37.6	39.16	174.4	72	82.53	105.6	65.77	67.40
0.125	1.07	0.590	34.6	13.96	99.51	91.8	53.43	92.59	41	16.93	99.46	50.4	31.39	98.78
0.063	0.26	0.419	1.1	0.44	99.96	11.4	6.64	99.23	1.3	0.53	100	1.6	1.0	99.79
0.045	0.137	0.354	0.1	0.04	100	0.7	0.41	99.64	0.0	0.0	--	0.1	0.06	99.85
Finer	--	--	0	.00	--	0.6	0.35	100	--	--	--	0.2	0.12	100

Barrel No. 3

Sieve size opening, mm	Estimated values		Sample No. 1			Sample No. 2			Sample No. 3			Sample No. 4		
	Settling velocity, cm/s	Scour velocity, ft/s	Weight retained on sieve, gm	Retained on sieve, %	Weight % with size >sieve opening	Weight retained on sieve, gm	Retained on sieve, %	Weight % with size >sieve opening	Weight retained on sieve, gm	Retained on sieve, %	Weight % with size >sieve opening	Weight retained on sieve, gm	Retained on sieve, %	Weight % with size >sieve opening
2	36.58	2.36	3.6	10.10	10.10	16.2	31.27	31.27	6	11.54	11.54	2.0	7.58	7.58
1	21.3	1.669	6.4	17.98	28.08	10.7	20.66	51.93	9.7	18.65	30.19	3.8	14.39	21.97
0.850	18.29	1.539	2.0	5.62	33.70	2.7	5.21	57.14	3.9	7.5	37.69	1.9	7.2	29.17
0.600	12.2	1.293	0.9	2.53	36.23	3.9	7.53	64.67	5.3	10.19	47.88	3.0	11.36	40.53
0.250	3.66	0.835	3.8	10.67	46.92	12.10	23.36	88.03	9.2	17.69	65.57	5.0	18.94	59.47
0.125	1.07	0.590	3.8	10.67	57.59	4.90	9.46	97.49	8.4	16.15	81.72	5.8	21.97	81.44
0.063	0.26	0.419	3.7	10.38	67.97	1.20	2.32	99.81	5.8	11.15	92.87	3.3	12.5	93.94
0.045	0.137	0.354	9.8	27.53	95.50	0.1	0.19	100	2.4	4.62	97.49	0.9	3.41	97.35
Finer	--	--	1.6	4.49	100	--	--	--	1.3	2.50	100	0.7	2.65	100

Table IV-8
(Reproduced from M & E 1979)

ANNUAL VOLUME OF BAYSIDE FLOWS BY SUB-BASINS

EXISTING CONDITIONS

Sub-Basin	Sanitary (Gal. x 10^6)	% of Total	Runoff (Gal.x10^6)	% of Total
Channel	14,546	65.3%	2,371	45.0%
Mariposa	217	1.0%	89	1.7%
Islais Creek	5,299	23.8%	2,032	38.6%
Evans-Hudson	57	0.3%	19	0.4%
Yosemite	1,248	5.6%	425	8.1%
Sunnydale	912	4.1%	332	6.3%
T O T A L S	22,279	100.1%	5,268	100.1%

Table IV-9

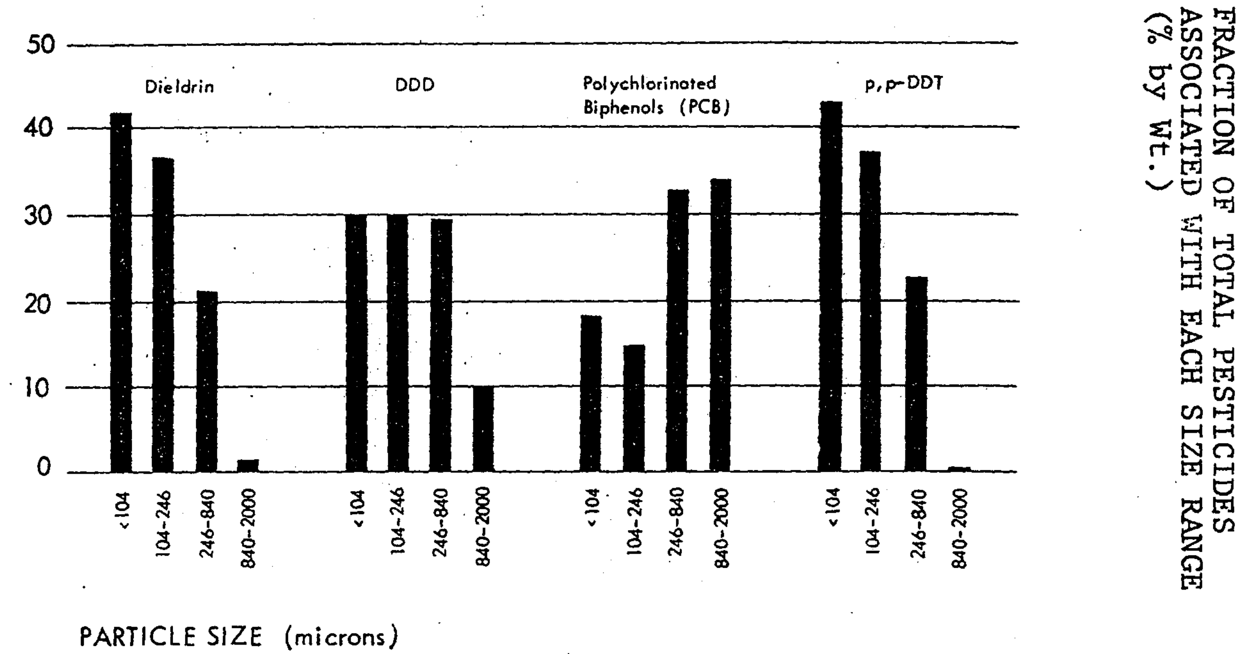


Fig. 24. Pesticide Concentrations - Variation with Particle Size

Figure IV-1
(Reproduced from EPA-1972)

SECTION V

BENEFICIAL USES OF THE AREAS IMPACTED BY BAYSIDE OVERFLOWS

Shoreline Area Impacted By Overflows

A series of dye studies and float studies were run on the Corps of Engineers hydraulic model of San Francisco Bay (Bay-Delta Model) for the purpose of determining the shoreline areas impacted by wet-weather overflows. All dye and float releases were made immediately after tidal current reversals (both ebb and flood) in order to establish the maximum distance an overflow discharge could travel. Upon reviewing a calibration test we ran on the model (an earlier field dye study at Northpoint plant was reproduced) and a similar model versus field study run in 1969 by the California Department of Water Resources (Fisher 1970), we have concluded the model seriously exaggerates the lateral dispersion of a discharge, especially during the first tidal cycle after release. Therefore, the following discussion of the shoreline areas impacted by wet-weather overflows should be considered conservative, that is, the area actually impacted may be considerably less than the model tests indicate. Preliminary data from the 1979 field studies also indicate that the impacted area is more limited than the model tests indicate.

The shoreline areas that would be most impacted by Bayside overflows may extend from approximately Pier 27/29 (foot of Battery Street) on the north to Sierra Point (in San Mateo County) to the south.

North of Pier 27/29, the ebb tide releases stayed offshore during ebb with some dye coming inshore after reversal. The dye path reached the shore of Alcatraz Island and Cavallo Point (Marin County). The maximum southerly extent of the dye patch and floats was opposite the sea-plane harbor at the San Francisco International Airport but the field remained offshore in the main ship channel south of Hunters Point.

The dye released at Yosemite remained in South Basin during the initial cycles after release (both ebb and flood). By the third cycle some dye had reached the tip of Candlestick and was curling westward around the tip. At the end of the tests (5th cycle after release) dye was still visible in South Basin. Dispersion from this location was very slow.

Both ebb and flood releases from Sunnydale moved longshore southerly to the Brisbane Lagoon culverts and into the Lagoon within a quarter cycle of release. The 1979 field studies indicate that the dominant movement from Sunnydale would be easterly toward the ship channel. It is possible that under strong north winds the field could move southerly along the Causeway as suggested by the model results.

In summary, the shoreline areas most likely to be impacted by Bayside overflows extends from Pier 27/29 on the north to Sierra Point in San Mateo County. The existing and proposed beneficial uses of this area are described in the following sub-section. These uses are based on Gilbert (1978), ESA (1979) and staff field observations.

Shoreline Beneficial Uses

Pier 27/29 to Pier 7

This area is currently in maritime use, consisting mainly of cargo handling, storage facilities a container facility at Pier 29. It is planned to continue maritime use in this area. A design plan for the entire area is required if maritime use is phased out. BCDC and City plans recommend public access areas for fishing and viewing along the waterfront if compatible with maritime activities.

Ferry Building Area

The area is currently under study by the city to determine future uses. Piers 1, 3, and 7 are currently in use by maritime support industries, with some public access for fishing. Pier 5 is scheduled for removal. Improvements to passenger facilities and commercial recreational operations in the Ferry Building are under construction. Piers 14, 16, 18, 20, 22, and 24 will be removed and replaced with a two-tiered waterfront promenade, boat dock and amphitheater.

North of Channel (China Basin)

This area is currently in maritime use, consisting of cargo handling, storage facilities, and maritime support industries.

Piers 26, 28, 30 and 32 are currently under renovation; continued maritime use is planned. Piers 34, 36, 38, 40, 42 and 44 are structurally unsound; future uses of this area could include commercial or residential uses. A proposal for a small boat marina in the vicinity of Piers 36 and 38 is currently under study by the city. A container facility at Piers 40, 42, 44, and 46A is currently under consideration by the Port if area plans call for continued maritime use. A new restaurant has opened on Pier 42.

Channel (China Basin)

This area is currently in maritime use, consisting of cargo handling, storage, and a container facility. There is some public access for fishing along Channel Street. A public boat launching ramp is located on China Basin Street south of Pier 50. Continued maritime uses are planned for the area. Expansion is planned for Pier 48. Improvements to the Channel Street area, including a marina, permanent houseboat facilities, and a small public park are currently under construction.

Central Basin

This area is mainly in maritime uses, i.e., cargo handling, dry docks, storage, and support industries. A boat-launching ramp, fishing, and viewing area are located south of Pier 64. Aqua Vista Park, a public access fishing and viewing area, is located at the southern end of China Basin Street; north of the park is another public access viewing area. Mission Rock Inn has a coffee shop and small boat berthing facilities.

Future plans for the area include consolidation of Piers 52, 54, and 64 into a new Pier 56 and expansion of Pier 70 to new Pier 72 and a new Pier 72 to accomodate new loading facilities. Plans for public facilities such as restaurants and a recreational marina at Pier 56 are currently under consideration by the Port. Consolidation of public access areas in the vicinity of Aqua Vista Park is also under consideration. A mini-park with fishing pier was recently completed at Warm Water Cove. Shellfish (clams) are present in the rocky beach areas at Warm Water Cove.

Islais Creek Channel

This area is expected to remain in maritime use, i.e., container, cargo handling, and storage facilities. A new coal terminal at Pier 94 is under development. Small public access areas are located on either side of the channel east of Third Street. However, use of these areas is minimal due to the lack of parking (parking is prohibited along Third Street). BCDC plans call for improved public access for the Islais Creek area.

India Basin

A LASH terminal is located at Pier 96. Pier 98, currently under development, was originally planned as a container facility; future use is now undetermined. Maritime support and other industrial uses are located south of Pier 98. There is minimal public access in this area.

Current maritime and industrial uses are planned to continue. The city recommends development of a public waterfront park between Pier 98 and Hunters Point, consisting of fishing areas, a marina with boat-launching ramp, picnic facilities, and open-space areas. A public access area near the Hunters Point Power Station is used by fishermen and there is berthing for a very limited number of small boats in the area. Shellfish are present in the rocky beach areas near the power plant.

Hunters Point Naval Shipyard

Some limited Navy support units are still stationed at the shipyard; however, the bulk of this facility is under lease to a private ship repair firm (Triple A). Future plans for the shipyard are uncertain.

South Basin/Candlestick Peninsula

This area has been acquired by the State for the Candlestick Point State Recreation Area and will be developed over a 20 year period as funding becomes available. Construction work for the initial facilities started in 1978. The development plan calls for group and family picnic areas, nature areas, fishing piers, boat rental and boat docking facilities and possibly a concessionaire operated restaurant complex. Park planners estimate maximum (summer weekend) usage upon completion at 11,250 visitors per day.

Candlestick Causeway Shoreline

Existing usage is minimal due to lack of legal access. A linear fisherman's park with fishing pier, foot path and bike path has been proposed for this area in conjunction with the proposed Sierra Point development (marinas, hotel, condominiums, etc.) but it is uncertain whether Caltrans will approve this proposal.

Brisbane Lagoon

While there is no legal public access to the lagoon, physical access is easy and the lagoon has been extensively used for fishing and shellfishing. Southern Pacific Transportation Company, one of the major owners of the lagoon, has recently posted this area against trespassing which may deter usage. Future plans for the lagoon are unknown.

Estimates of Existing Water Contact Usage

Environmental Science Associates surveyed this area (Figure V -1) in January and February 1979 to determine the present level of water contact activities and the results of their survey are shown in Table V-1. Fishing and shellfishing were the only water contact activities observed. No effort was made to quantify non-contact activities (jogging, walking, etc.).

Fish and Wildlife Resources

Bottom trawls were conducted on April 6, 1979 for the purpose of obtaining a qualitative evaluation of the resident fish populations near the major Bayside overflows. These one-time trawls would have missed migratory fish that are not normally resident in the Bay at that time of the year, e.g. many pelagic species and fast swimming species (e.g. bass) that could easily elude the trawl nets. Therefore the species list (Table V-2) should not be considered as an all-inclusive list of marine resources. Four bottom trawls were also conducted off the mouth of Islais Creek between December 1973 and October 1974 as part of studies for a proposed outfall at this location (Brown & Caldwell - 1975). The durations of the 1973 and 1974 trawls were considerably longer than the 1979 trawls which may be one reason why the species lists (Table V-3) for the earlier trawls are more comprehensive. Most of the fish found in both in the 1973-1974 and 1979 trawls were small, (young-of-the-year) which would indicate that the Bay is a nursery ground for many species.

The species list of intertidal organisms found by Sutton (1978) in the intertidal areas between Warm Water Cove and the Brisbane Lagoon is reproduced as Table V-4. Infauna data from the 1979 dredge sampling is not yet available but will be pulished as part of the comprehensive report for that survey.

Fish Migration

Fish migration has been identified as a beneficial use of San Francisco Bay (Basin Plan - 1975). The main migratory routes for anadromous fish is directed towards the Delta (Basin Plan - Fig. 11-15) and therefore lies several miles to the north of the most northerly Bayside overflow structure. Coho salmon formerly migrated through the central and South Bay to spawning areas in streams tributary to the South Bay but these migrations have apparently ceased and spawning of the present population is restricted to coastal streams. Some steelhead may still migrate to South Bay streams to spawn (Basin Plan).

Fish Spawning

The Basin Plan identifies the San Francisco shoreline south of the Bay Bridge and the San Mateo shoreline as spawning grounds for the pacific herring. Herring normally spawn from December through April but specific spawning sites are unknown. Sutton (1978) reported finding many spawning plainfin midshipman under flat rocks at Candlestick Point in July of 1978. The species has no local commercial importance but is extensively harvested in Mexican waters (Sutton 1978).

Aquatic Birds

There are apparently no nesting sites for aquatic birds in the area most effected by Bayside overflows. (Basin Plan-Figure 11-20).

Rare or Endangered Species

There are apparently no rare or endangered species in the area most affected by Bayside overflows (Basin Plan-Figure 11-23).

RECREATIONAL USAGE OF SAN FRANCISCO BAY WATERFRONT (ESA SURVEY)

Map*** Symbol	Location	Persons Clamming For Food*	Persons Collecting For Bait**	Evidence of Collection*	Persons Fishing*
A	Piers 24-64	not surveyed	not surveyed	not surveyed	131/7
B	Central Basin (Aqua Vista Park & Mission Rock Inn)	0/4	0/4	o/4	47/6
C	Warm Water Cove	0/10	18/10	3/10	78/10
D	Islais Creek Channel	0/9	18/10	1/9	10/9
E	India Basin	13/9	3/9	1/9	162/9
F	Yosemite Channel	0/9	0/9	1/9	0/9
G	Candlestick Peninsula	0/8	0/8	0/8	6/9
H	Candlestick Pier	0/8	2/8	6/8	18/8
I	Candlestick Cove	6/11	0/11	0/11	0/12
J	Along Hwy. 101	0/4	0/4	0/4	0/4
K	Brisbane Lagoon	6/12	6/12	0/12	23/11

*The fractions given represent the number of persons observed participating in the activity over the number of observations taken at the specific area.

**Bait collected included pile worms, clams, shrimp, crabs and mussels.

***See Figure V-1

Table V-1
Source ESA (1979)

SPECIES LIST BY AREA TAKEN BY BOTTOM TRAWLS
6 APRIL 1979

YOSEMITE OUTFLOW AREA

Starry flounder	Platichthys stellatus
Pipefish	Syngnathus sp.
Staghorn sculpin	Leptocottus armatus
Pacific sanddab	Citharichthys sordidus
Pacific herring	Clupea harengus
English sole	Parophrys vetulus
California halibut	Paralichthys californicus
Shiner surfperch*	Cymatogaster aggregata

SUNNYDALE

Diamond turbot	Hypsopseta guttulata
Starry flounder	Platichthys stellatus
English sole*	Parophrys vetulus
Pacific sanddab	Citharichthys sordidus
California halibut	Paralichthys californicus
Speckled sanddab	Citharichthys stigmaeus
White sanddab	Phanerodon furcatus
Bay goby	Lepidogobius lepidus

ISLAIS-MOUTH

Northern anchovy	Engraulis mordox
Smelt	Spirinchus sp.
Midshipman	Porichthys sp.
Pacific tomcod	Microgadus proximus
White croaker	Genyonemus lineatus
Shiner surfperch*	Cymatogaster aggregata
English sole	Parophrys vetulus
Pacific sanddab	Citharichthys sordidus
Rockfish	Sebastes sp.
Staghorn sculpin	Leptocottus armatus
Yellowfin goby	Acanthogobius flavimanus

ISLAIS-INSIDE

Pacific sanddab	Citharichthys sordidus
Smelt	Spirinchus sp.
Northern anchovy	Engraulis mordox

CHANNEL-MOUTH

Shiner surfperch	Cymatogaster aggregata
Staghorn sculpin	Leptocottus armatus
Midshipmen	Porichthys sp.
Pacific tomcod	Microgadus proximus
Northern anchovy	Engraulis mordox
Bay goby	Lepidogobius lepidus
California halibut	Paralichthys californicus
English sole	Parophrys vetulus
Yellowfin goby	Acanthogobius flavimanus
Pacific sanddab	Citharichthys sordidus
Pipefish	Syngnathus sp.

CHANNEL-INSIDE

Northern anchovy	Engraulis mordox
Shiner surfperch	Cymatogaster aggregata
Pacific sanddab	Citharichthys sordidus
Pacific herring	Clupea harengus

*Most Abundant

Table V-2
(Cont.)

Table 5-6. Species of Fishes Collected by Trawling in the Vicinity of the Southeast WPCP Outfall, South San Francisco Bay, 1973-1974

Species	December 1973		March 1974		May 1974		October 1974		Total	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
Northern anchovy	25	35	276	6134	52	679.5	4	20.5	357	6869
Speckled sanddab	20	141	170	1160	31	276.8	61	440	282	2017.8
Shiner surfperch	61	1007	116	1834	10	274	17	250	204	3365
Brown rockfish	24	602	105	1922	24	1529.5	24	2100	177	6153.5
English sole	2	62	63	2142	42	2429	6	62	113	4695
Pacific herring	42	207	1	6	12	109.9	11	63.5	66	386.4
Plainfin midshipman	1	0.5	1	2	48	2559.5	-	-	50	2562
White crocker	5	54	5	1063	25	3316	-	-	35	4433
Pile surfperch	5	140	14	964	1	398	13	1805	33	3307
Pacific tomcod	1	23	19	45	11	402	2	16	33	486
Staghorn sculpin	-	-	23	1259	3	107.5	-	-	26	1366.5
White surfperch	1	133	12	353	1	22	10	543	24	1051
Bay goby	1	4	10	32	9	35.5	2	10	22	81.5
Whitebait smelt	-	-	-	-	9	41.7	-	-	9	41.7
Smelt, unident	-	-	-	-	9	4.8	-	-	9	41.8
Starry flounder	1	657	1	498	-	-	2	2700	4	3855
Threadfin shad	4	72	-	-	-	-	-	-	4	72
Spiny dogfish	-	-	-	-	4	12,034	-	-	4	12,034
Longfin smelt	-	-	4	10	-	-	-	-	4	10
Lingcod	-	-	3	308	-	-	-	-	4	308
Bay pipefish	1	2	-	-	-	-	2	5	3	7
Bonyhead sculpin	1	63	2	22	-	-	-	-	3	85
Black rockfish	-	-	-	-	3	4.3	-	-	3	4.3
Walleye surfperch	1	33	-	-	1	2.5	-	-	2	35.5
Brown smoothhound	-	-	-	-	1	790	-	-	1	790
Yellowfin goby	-	-	1	42	-	-	-	-	1	42
Leopard shark	-	-	1	1950	-	-	-	-	1	1950
Pacific electric ray	-	-	-	-	-	-	1	374	1	374
Big skate	-	-	-	-	1	474	-	-	1	474
Spotted cusk-eel	-	-	1	66	-	-	-	-	1	66
Rubberlip surfperch	-	-	-	-	-	-	1	648	1	648
Striped bass	-	-	1	15.4	-	-	-	-	1	15.4
California tonguefish	-	-	-	-	1	19	-	-	1	19
Diamond turbot	-	-	-	-	-	-	1	202	1	202
Total	196	3235.5	829	19,966	298	25,509.5	157	9239	1481	57,950
Total number species	17 species		21 species		21 species		14 species		34 species	

Table V-3
Reproduced from B & C (1975)

COMPREHENSIVE SPECIES LIST
(per Sutton-1978)

MOLLUSCA

BIVALVIA

ORDER: MYTILOIDA
FAMILY: MYTILIDAE
Ischadium demissum (Dillwyn, 1817) (ribbed horsemussel)
Musculus senhousia (Benson, 1842) (mud mussel)
Mytilus edulis Linnaeus, 1758 (bay mussel)

ORDER: PTERIOIDA
FAMILY: OSTREIDAE
Ostrea lurida Carpenter, 1864 (native or Olympia oyster)

ORDER: VENEROIDA
FAMILY: TELLINIDAE
Macoma balthica (Linnaeus, 1758)
Macoma inquinata (Deshayes, 1855)
Macoma nasuta (Conrad, 1837) (bent-nosed clam)
FAMILY: VENERIDAE
Tapes japonica Deshayes, 1853 (Japanese littleneck clam

ORDER: MYOIDA
FAMILY: MYIDAE
Cryptomya californica (Conrad, 1837)
Mya arenaria Linnaeus, 1758 (soft-shell clam; steamer clam)
FAMILY: PHOLADIDAE
Zirfaea pilsbryi Lowe, 1931 (rough piddock)

GASTROPODA

ORDER: NEOGASTROPODA
FAMILY: MELONGENIDAE
Busycotypus canaliculatus (Linnaeus, 1758) (channeled whelk)
FAMILY: MURICIDAE
Urosalpinx cinerea (Say, 1822) (oyster drill)
FAMILY: NASSARIIDAE
Ilyanassa obsoletus (Say, 1822) (mud snail)

ANNELIDA

POLYCHAETA

ORDER: PHYLLODOCIMORPHIDA
FAMILY: GLYCERIDAE
Glycera robusta Ehlers, 1868
FAMILY: NEPHTYIDAE
Nephtys caecoides Hartman, 1938
FAMILY: NEREIDAE
Neanthes succinea (Frey and Leuckart, 1847)
Neanthes virens (Sars, 1835)
Neanthes sp.
Nereis vexillosa Grube, 1851 (epitokous)

TABLE 1. (cont'd)

ANNELIDA

POLYCHAETA

ORDER: CIRRATULIMORPHIDA
FAMILY: CIRRATULIDAE
Cirriformia spirabrancha (Moore, 1904)

ORDER: CAPITELLIMORPHIDA
FAMILY: MALDANIDAE
possible *Asychis elongata* (Verrill, 1873)
(pygidium missing)

ARTHROPODA

EUCARIDA

ORDER: DECAPODA

SECTION: CARIDEA
FAMILY: PALAEMONIDAE
Palaemon macrodactylus Rathbun, 1902

SECTION: ANOMURA
FAMILY: CALLIANASSIDAE
Upogebia pugettensis (Dana, 1852) (blue mud shrimp)

FAMILY: PAGURIDAE
unidentified hermit crabs

SECTION: BRACHYURA
FAMILY: GRAPSIDAE
Hemigrapsus oregonensis (Dana, 1851)

CHORDATA

ASCIDIACEA

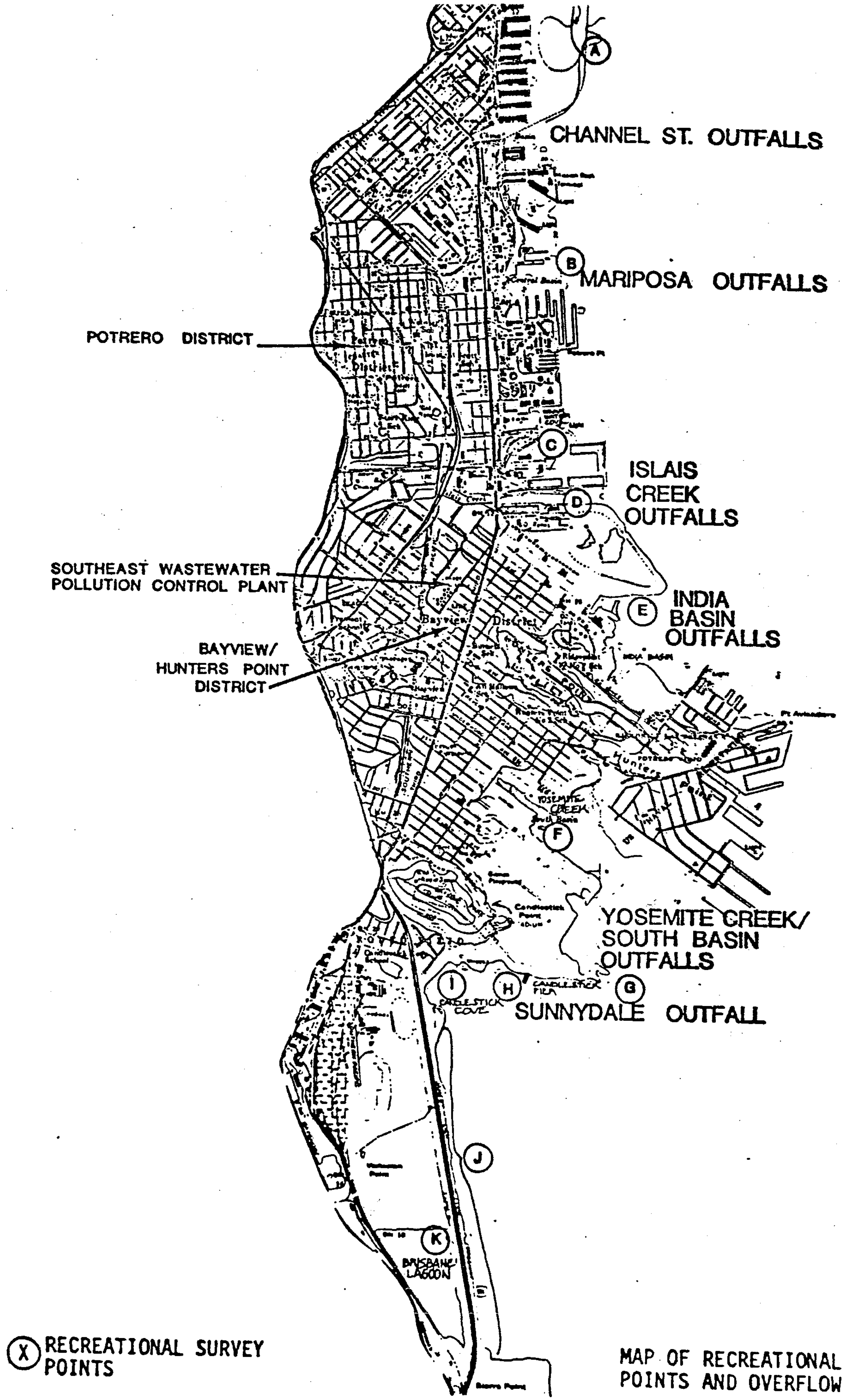
ORDER: ENTEROGONA
FAMILY: ASCIDIIDAE
Ascidia ceratodes (Huntsman, 1912)

ORDER: PLEUROGONA(?)
FAMILY: MOLGULIDAE(?)
possible *Molgula manhattensis* (DeKay, 1843)

OSTEICHTHYES

ORDER: PERCIFORMES
FAMILY: BATRACHOIDIDAE
Porichthys notatus Girard 1854 (plainfin midshipman)

Table V-4 (Cont.)
Intertidal Species
List per Sutton
(1978)



MAP OF RECREATIONAL SURVEY POINTS AND OVERFLOW OUTFALLS

Figure V-1

SECTION VI IMPACTS OF OVERFLOWS

Introduction

In order to ascertain the temporal and areal extent of impacts from combined sewer overflows, the City retained a consultant to monitor the physical & chemical properties of the Bay during overflows and for five days following the cessation of overflows. The field studies were concentrated at Channel, Islais Creek and Yosemite as these areas contain the largest Bayside overflow structures and would have the greatest potential for measurable impacts due to the confined nature of these areas. Monitoring was also done of the Sunnydale overflows as this structure is in close proximity to a known shellfish area. The field work is completed and data reduction and analysis is in progress. A comprehensive report on this study is scheduled for publication in mid-May 1979. Available data from the field studies is incorporated in the following discussions.

The impacts of overflows have been categorized into esthetic impacts; public health concerns, including impacts on potential commercial shellfishing; altered substrate impacts; and impacts on marine organisms. A preliminary evaluation of possible impacts is as follows:

Esthetics

Floating solids and discoloration of the water surface is noticeable during the overflows and for approximately 12 to 25 hours (½ to 1 tidal cycle) afterwards. The generally westerly winds tend to move the floatable material offshore into open waters. An exception to this occurs at Channel where the houseboat dwellers have reported seeing overflow debris in the dock piling areas for a few days following overflows. The overflows from the heavily debris laden early-season storms are the biggest problem. Shoreline accumulations of debris are very difficult to evaluate in the Bayside area as much of the shoreline is inaccessible. A large amount of visible material (plastic bags, tin foil, etc.) settles out a short distance from the overflow structures).

The open shoreline areas in the Yosemite and Sunnydale areas do not appear to attract debris probably due to the generally offshore winds. No visible evidence of overflow originating material is evident, although the general poor condition of both areas also tends to obscure any slight additions.

Public Health

Receiving water coliform levels will exceed the body contact levels specified in the California Administrative Code for about three days following each overflow. However there have been no reported cases of illness due to swimming in San Francisco Bay or the contiguous portion of the Pacific Ocean (Appendix A). Transmission of enteric disease through swimming in fecally contaminated natural bodies of water is relatively rare in the United States. The only reported outbreak of enteric disease in 1977 due to swimming in fecally contaminated waters occurred in a swimming pool (Cabelli-1978). Public health statistics do not have minor illnesses as most people do not seek medical assistance for such illnesses or if they do, the diagnosis is frequently not confirmed by clinical testing.

Swimming is currently very rare in the portion of the Bay affected by Bayside overflows (ESA - 1979). The Bay waters are not suitable for surfing or skin diving nor are there currently any beach areas suitable for wading. Completion of the Candlestick Point State Recreation Area could result in an increase in swimming and wading but to what degree is unknown. The area is not attractive for swimming and wading due to the turbid waters and either muddy or rocky substrate.

Fecal coliform levels in shellfish tissue will increase significantly following an overflow and may remain above the National Shellfish Sanitation Program (NSSP) standards (230 MPN/100 gm) for one to two weeks afterwards. A 1972 EPA survey of Bay shellfish beds reported above-standard fecal coliform levels in shellfish tissue from Bayview Park (Sunnydale Overflow) several days after overflows (EPA-1974). However the tissue levels at Bayview were not significantly different than the tissue levels reported for other Bay shellfish beds. Water column coliform levels were erratic at Bayview following overflows. In one case, water column coliform levels (both total & fecal) dropped to less than 2 MPN/100 ml within about 36 hours after an overflow but oscillated between the limit of detection and values as high as 2400 MPN/100 ml (total) during the ensuing week. Unfortunately the time of collection was not published as it would be interesting to compare the coliform levels with the tide stage at the time of collection.

Fecal coliform levels in shellfish tissue will frequently exceed standards during summer dry-weather conditions (See Appendix E).

Clams are recreationally harvested for food in the impacted areas (Sutton - 1978, ESA - 1979). Harvesting of mussel or oysters has not been observed. Clams and mussels are generally cooked and, if properly cooked, would present little risk of disease (Dritz-Appendix A). Oysters would present the greatest risk as these are frequently consumed raw. However the native oysters, Ostrea lurida, in this area are too small (typical size is about 1½"), too sporadically distributed and too firmly attached to their substrate to attract the shellfisher's interest (Sutton - 1978). There have been no reported cases of illnesses attributable to the consumption of shellfish harvested in San Francisco Bay (Appendix A). As noted earlier minor illnesses are rarely reported. Heavy metal and trace organic contamination of shellfish is an area of possible concern as shellfish can concentrate these substances to levels substantially above environment levels. With one exception, reported levels of heavy metals and trace organics in clams from Sunnydale have been within FDA standards. The one exception was a 10.5 ppm level of lead reported in a 1972 survey (EPA - 1974). FDA standards are predicated on the assumption of frequent consumption; occasional consumption of over-standard shellfish may not therefore be a significant problem. Note that Girvin (1974) found very low levels of lead in clam tissue at this location. However his data is for depurated clams and is therefore not comparable to FDA standard. Riseborough (1978) reported very low levels of lead in mussels taken from this same area. In addition, data from the 1979 Supplementary Monitoring Program indicate that the highway culverts near the Sunnydale outfall are a significant source of lead.

Impacts on Commercial Shellfishing (Potential Beneficial Use)

There is presently no area in San Francisco Bay approved for commercial shellfish harvesting (Jones & Stokes 1977), though the Foster City beds have been conditionally approved for harvesting for transplanting to Tomales Bay. Between 1851 and 1910 South Bay was extensively used for oyster growing. The cause of the decline in the oyster industry is uncertain but may have been the result of pollution (Jones & Stokes 1977). There has been recent interest in reestablishing commercial shellfishing and mariculture in San Francisco Bay. Whether the areas impacted by overflows are suitable for commercial use is unknown. The intertidal clam beds in this area are probably not of sufficient size to support commercial harvesting and such harvesting would possibly conflict with recreational use of the shoreline. Dredging or other mechanical harvesting methods are prohibited under current Fish & Game Regulations (Walt Dahlstrom. pers comm). This prohibition would preclude harvesting of sub-tidal clams. Current studies by Walt Dahlstrom using the Pacific Oyster (Grassostrea gigas) show excellent growth rates in the Anza & Brisbane Lagoons but only moderate growth rates at Candlestick Point, possibly due to the stronger wind induced waves and lower salinities at this location.

The area offshore of the Candlestick Causeway may be suitable for oyster mariculture. However, many fishing boats visit this area and pilferage or vandalism could be a problem unless the beds are guarded.

Wintertime harvesting of these beds could be unacceptable to public health authorities even if combined sewer overflows are completely eliminated. Fecal coliform levels in urban runoff will frequently exceed 10^4 MPN/100 ml and may reach 10^6 MPN/100 ml (Sacramento -1975, Seattle - 1979, ABAG 208 studies 1978). Fecal coliform levels in the discharge from the Candlestick Causeway highway culverts are in the 10^3 to 10^5 MPN/100 ml range (Appendix B). A 1973 DHS survey of 15 shoreline sites in San Francisco Bay after a light rains found that 14 of the stations would have been classified as 'prohibited' and one would have been classified as 'restricted' (Jones & Stokes 1977). The epidemiological significance of high coliform levels in urban runoff is uncertain. Jones & Stokes cited one report (Fufari - 1968) that suggested that the virus to coliform ratio in urban runoff was twice that of sewage. If current NSSP bacteriological standards remain in effect it would appear that few if any nearshore areas of San Francisco Bay could meet shellfish standards through much of the rainy season even if sewage overflows are eliminated entirely. For a thorough discussion of the public health issues relating to commercial harvesting of Bay shellfish see Jones & Stokes - 1977.

Altered Substrate

The westerly one-half to two-thirds of the bottoms of Islais Creek and Channel are covered by anoxic sludge. Sewage items (e.g. 'Handi-wipe' towels, tin foil) were recovered from the blankets. As a result it is assumed that the overflows are a contributing cause of these deposits. The problem appears more severe at Channel than at Islais Creek which would be consistent with the relatively higher percentage of sanitary sewage in the Channel overflows. It is unknown whether these deposits are seasonal or perennial as no dry-weather data is available. Benthic organisms are sparse to non-existent in the areas of heavy sludge deposits.

It may not be assumed, however, that overflows are the major if not the sole source of organic debris at these locations. Both locations are subject to other non-point organic loadings (i.e. boat wastes), and by being narrow, confined backwaters would tend to accumulate detritus from the main body of the Bay. Also, drilling logs from the geological exploration for the I-280 freeway indicate that this entire area is laced with pockets of very organic fill materials and muds (Cal-trans-1969), indicating historically high organic material in these sediments.

Anoxic surface conditions have also been reported for the inter-tidal mud-flats at Yosemite/South Basin (Sutton 1978). However, such anoxic conditions are frequently encountered in mud-flats and salt marshes that are free of gross pollution. In addition, this area has been extensively used as a dump; some areas being completely covered with solid wastes. It is not possible to disaggregate the relative significance of natural effects, dumping and overflows in the formation of the anoxic surface conditions; nor would it be possible to predict the changes, if any, that would result from a reduction in the number of overflows. Conditions at Evans/Hudson and Sunnydale are similar to Yosemite/South Basin except that anoxic conditions are much less extensive. This may be in part due to stronger currents and turbulence in those areas.

No evaluations of sludge conditions were made of the Embarcadero or Central Basin overflow points. Seattle studies (Seattle - 1977 & 1979) found sludge deposits at CSO structures located in confined areas but no sludge deposits at CSO structures located in areas of reasonably good circulation. The Embarcadero & Central Basin structures are in areas of strong currents and sludge deposits presumably would not be a problem.

Marine Organisms

Acute effects

A preliminary analysis of the field monitoring data suggests the following dilution/dispersion characteristics:

(1) The field is essentially confined to the top 2' to 6' of the water column.

(2) The field disperses rapidly beyond the mouths of Islais Creek and was not detectable (50:1 dilution or greater) beyond about 0.6 miles from the mouth.

(3) Dilution during the overflow is very low, typically less than 1:1 (50% concentration), at the surface in confined areas; however, break up and dispersion of the field in these confined areas is rapid following cessation of the overflow. For example, a ten-fold decrease in peak concentrations occurred during the ensuing ebb tide in Islais Creek following the overflow of February 20, 1979.

(4) A full return to background salinity conditions will occur within 50 to 75 hours following cessation of overflows.

(5) With the exception of a few anomalous readings near the 3rd Street Bridge (Channel) all receiving water pH values were within the 7.0 to 8.5 range.

(6) With the exception of the head-ends of Channel & Islais Creek, dissolved oxygen (D.O.) sags were modest. D.O. levels rarely dropped below 7.5 mg/l and in no case dropped below the 5.0 mg/l Basin Plan minimum. One severe D.O. sag occured at the head-end of Islais Creek. D.O. levels at the head-end of Channel dropped to a low of 20% of saturation.

(7) The temperature of the overflow would rarely exceed background water temperatures by more than 2°C. Elevated water temperatures resulting from overflow should rarely, if ever, be a problem.

It appears that overflow impacts in the water column are transient and highly localized phenomena. Acute toxic effects in the receiving water have not been specifically studied but there is some evidence to suggest that acute toxic effects would also be localized and minor. The toxicity of undiluted overflows, as measured by standard bioassay tests, while marginal with respect to discharge standards for treated effluents, are generally low.

One might expect to find the greatest effects in the intertidal and immediate sub-tidal areas as the overflow field is highly stratified in the upper few feet of the water column. Sutton however could not find any correlation between shellfish populations and distance from overflow structures (Sutton-1978). Mussels and barnacles can be found growing on overflow structures (e.g. Sunnydale) or on pilings immediately in front of the overflow structures (e.g. Selby St.). A dense set of barnacles is, in fact, found inside of the Sunnydale structure.

Pelagic fish may dive below the most concentrated portion of the overflow field in response to detecting lowered salinities or certain chemical constituents in the field, thereby avoiding the brunt of the impact. Demersal fish (bottom dwellers) and sub-tidal benthic organisms will generally be below the more concentrated portion of the overflow field. However data is not yet available to determine acute effects of CSO's on the infauna.

The number of species and total biomass of the fish found near the head-ends of Channel & Islais Creek are significantly lower than are found at the mouths of these two channels. This paucity of fish is likely due to lack of naturally occurring food in the sludge deposit areas, and possibly unsuitable chemical quality of the sediments. It should be noted that none of the fish caught in the bottom trawls displayed tumors, discolorations, or other superficial abnormalities.

Chronic Effects

Repeated short-duration exposures to sub-lethal concentrations of various contaminants could result in a build-up of contaminants in the tissues which in turn could produce chronic effects such as death or reduced reproduction. These effects, if present, would most likely appear in attached, or relatively immobile organisms found in the immediate vicinity of the outfalls.

The extent of chronic toxicity problems due to CSO is unknown and perhaps undeterminable. The best method of evaluating depressed conditions due to chronic toxicity would be to compare the marine resources adjacent to overflow structures with the marine resources at a control area that was essentially identical in other important respects (i.e. substrate, salinities, circulation, proximity to other sources of contaminants, etc.). No such control site(s) is (are) available.

Long-term laboratory experiments to determine chronic effects would be very difficult to design and execute as there is a real problem in keeping many sensitive species alive in a laboratory environment. (Note heavy mortality in the controls of species like Bay shrimp during the 1971 Brown & Caldwell studies). Additionally, it is impossible to extrapolate such studies to field areas. Field studies to monitor heavy metals uptake could be run on attached or planted macro-fauna. However, it would be impossible to preclude contamination from other sources and it is not yet possible to assign toxicological meaning to tissue concentrations (Girvin - 1978). Any realistic attempts at field study determinations would take several years with the same organisms and would be subject to problems of organism mortality unrelated to CSO effects during the long study period.

Three field studies may provide indirect evidence that chronic toxicity problems near overflow outfalls may be only minimal. As noted earlier, Sutton in 1978 could not find any apparent correlation between populations of clams and proximity to outfalls. Sutton in 1979 reported normal attached macro-fauna on the Seacliff outfall and the rock cliffs a few meters away from the outfall. The Seacliff outfall is, however, located in an open coast environment and the observations made here may not be applicable to confined areas within the Bay. The third study of interest is a 1975 study of trace metal and chlorinated hydrocarbon levels in selected bay shellfish (Girvin-1975).

Samples for this study were collected in mid-April 1975 from approximately 15 beds located throughout San Francisco Bay. The 1974-1975 wet-weather season had approximately average rainfall; however, very late season rainfall (March, early April) was well above average. This study found no correlation between lead levels in shellfish and the proximity to major sources of urban runoff. Shellfish taken from the Bayview Park bed, which is adjacent to the Sunnydale overflow structures, had some of the lowest levels of trace metal contamination found in their study. High trace metals levels were found in the mussels taken at Islais Creek; however, this area is directly onshore of the outfall from the Southeast Treatment Plant and is subjected to non-point sources of contamination other than wet-weather overflows. Unfortunately, neither Bayview Park nor Islais Creek were among the limited number of beds sampled for chlorinated hydrocarbon contamination.

The San Francisco overflows do not appear to play a significant role in heavy metals concentrations in areas removed from the immediate proximity of the overflow structures. Girvin, et al., sampled water column heavy metal levels during the 1976 and 1977 drought years (Girvin - 1978). Of particular relevance is the data from the samples collected on March 1, 1976 as 0.78" of rain fell on the preceding day (there may also have been a very small overflow during the pre-dawn hours on March 1, 1976). Included in the sampling were two stations approximately 1½ miles offshore of San Francisco. A comparison of the heavy metals concentrations found at these stations with Ocean Plan water quality objectives is provided in the following table:

Concentrations (1) (Ug/1)

	Silver	Cadmium	Copper	Nickel	Lead	Zinc
Station 24 (2)	0.05	0.13	2.6	2.5	1.2	2.2
Station 21 (3)	0.05	0.15	2.3	2.2	1.2	3.2
Ocean Plan (4)	0.45	3	5	20	8	20

NOTES:

(1) Dissolved plus particulate

(2) 1½ miles southeasterly of Hunters Point

(3) 1½ northeasterly along the Bay Bridge

(4) 6-month median values

As noted in this table, all measured values are one-half or less than the Ocean Plan objectives.

A comparison of emissions of total heavy metals (cadmium, chromium, copper, lead, mercury, nickel, and zinc) from San Francisco's wet-weather overflows with total Basin loadings resulting from a two-year storm indicates that the City's overflows account for only 5% of the storm loadings (Basin

Plan Table 5-8). No comparisons can be made on loadings of chlorinated hydrocarbons and PCBs as published data on these substances is extremely limited. However, measured values (B & C 1979) in San Francisco's overflows for total identifiable hydrocarbons and PCBs fall within the strictest effluent standard of 2.0 ug/l. It is therefore assumed that trace organic loadings from overflows do not present a problem in and of themselves nor would they constitute a disproportionately high percentage of total Bay loadings.

Effects on Fish Migration and Fish Spawning

Most anadromous fish migratory routes are directed towards the Delta and, therefore, lie northerly of the Bay Bridge (Basin Plan -Figure 11-15). Coho salmon formerly migrated into the South Bay but apparently no longer do so. Some steelhead may migrate into tributary streams of the South Bay. Steelhead migrations occur during April, May and to a lesser extent, September (Basin Plan). The effects of Bayside overflows on the migration of anadromous fish may be minimal as the main route is three miles or more from the major Bayside overflows and while steelhead may pass in closer proximity to Bayside overflows, their migration are during months of low to moderate rainfall during which few overflows will occur.

The Basin Plan identifies the San Francisco shoreline south of the Bay Bridge as a spawning area for Pacific Herring. Spawning of herring apparently is occurring near San Francisco under existing conditions as evidenced by the preponderence of small juveniles of this species found in the 1979 bottom trawls. Reduction in the number of overflows may improve spawning but to what degree, if any, is uncertain.

Sutton (1978) reported finding considerable numbers of spawning plainfin midshipman under the intertidal rocks at Candlestick Point. Spawning season for the midshipman is apparently during summer and early fall, periods of very little rainfall. This, coupled with the distance from overflow structures, would suggest the overflows would have little or no adverse effects on the spawning of the midshipman.

Summary

In summary, the major adverse effects of overflows appear to be the potential health hazard to shellfishers, the sludge blankets in Islais Creek & Channel and the potential for very localized acute and/or chronic toxicity problems in these confined areas. Shellfishing is practised by only a handful of people and there are measures (posting) that can be implemented to warn the shellfishers of the potential health problems. The depressed areas within Islais Creek and Channel total less than 0.02% of the total area of San Francisco Bay. Even if overflows into these areas were entirely eliminated, it is unlikely that these areas would become areas of rich and diverse marine life due to their confined nature and contamination from shoreline and maritime activities.

VII. BAYSIDE FACILITIES

Master Plan Concepts (Southwest Facilities Plan 'Best-Apparent Alternative')

In order to determine the optimum size for the Southwest Treatment Plant, the City's consultant made a thorough re-evaluation of the 1971 Master Plan and its 1973 supplement. This re-evaluation confirmed the basic wet-weather flow-routing of the plan, to wit: consolidation of all Bayside wet-weather flows at a point near Islais Creek, a major multi-purpose pump station at Islais Creek, a dual and perhaps triple purpose east-west cross-town tunnel to carry these flows to the southwest corner of the City, and a single wet-weather treatment plant with deep ocean discharge located immediately south of the Zoo. All Bayside and Northshore dry-weather flows will receive secondary treatment at the expanded Southeast plant (under construction). The treated effluent will be conveyed via the Islais Creek Pump Station and the cross-town tunnel to the headworks of the Ocean Outfall. Upon completion of the Master Plan facilities, there will be no discharge of treated effluents into San Francisco Bay.*

The Bayside transport/storage facilities needed to implement the Master Plan are shown on Figure VII-1 and described in the following sub-sections. Construction work is under way for a portion of these facilities (see Accelerated Program).

*This proposal is contingent on approval of the EIR for the Southwest Treatment Plant.

With the obvious exception of the facilities already under construction, the following facilities will be subjected to detailed facilities planning, including environmental review. The final recommended facilities could differ somewhat from those described above. Consultant proposals for providing facilities planning have been received and selection of the consultant should be completed by the end of May.

Channel (China Basin) Outfalls Consolidation

These facilities are large rectangular concrete structures designed to collect and store wet-weather flows draining into Channel (China Basin). In addition they provide one element of the transport facilities needed to convey dry and wet-weather flows from the Northshore Outfalls Consolidation to Islais Creek. If the permitted number of overflows is eight per year or greater, the Channel facility already under construction would provide adequate storage to meet requirements. A permitted overflow frequency of four per year or less may necessitate the construction of additional storage facilities in the area (see Figure VII-1)

Low Level North-South Tunnel (or Force Main)

A transport facility will be needed to convey Channel and Northshore flows to the consolidation point near Islais Creek. Preliminary analysis favors a gravity tunnel constructed in part by cut and cover and in part underground headed. An alternative would be a force main with an additional pump station at Channel.

Mariposa Basin Facilities

Transport/Storage facilities will be required to intercept wet-weather flows from the two relatively small overflow structures in this area. The intercepted flows could be conveyed either by gravity or pumping north to the Channel Outfalls Consolidation, east to the low-level tunnel, or directly south to the Islais Creek facilities.

Islais Creek Transport/Storage Facilities

It is here that the overflow frequency issue will have its greatest social and economic impact,as the initial analysis for the Bayside Facilities favors the streets in the industrialized area southeast of Islais Creek as the location for much of the total Bayside storage volumes. Few opportunities exist for off-street storage facilities; therefore these facilities will have to be built under the streets either by cut and cover construction with its attendant traffic and access problems or by very sophisticated and expensive soft ground tunneling techniques. (The Cost estimates are predicated on cut and cover construction). Construction has started on the initial portion of the required Islais Creek facilities; however, the volume provided by these initial facilities is but a small percentage of the total required volume.

Hunters Point Facilities

A six foot diameter and two small diameter overflow structures discharge into India Basin. Additionally, it may be desirable to provide transport capacity in this area for the purpose of receiving runoff flows from the separate sewer system within the Navy Base as runoff from portions of the base may contain high concentrations of toxic materials. Preliminary analysis favors a transport/storage facility at India Basin to intercept these three outfalls and to convey this flow to Islais Creek via pump station, a short force main, and the existing sewer system.

Yosemite Facilities

Transport/storage facilities encircling Yosemite Canal will be required to intercept and store flows from the three overflows discharging into this canal and South Basin. These facilities will in part be located within the boundary of the Candlestick Point State Recreation Area (under development). Close coordination with the State Department of Parks and Recreation will be required to develop a mutually acceptable system. Intercepted flows from this area will be conveyed by gravity through cut and tunnels to the Islais Creek pump station. Additional transport/storage facilities will be required along adjacent side streets if less than four overflows per year is specified.

Sunnydale Facilities

Sunnydale is the southernmost overflow outfall in the City system and discharges into Candlestick Cove just south of the county line. The proximity of the Freeway severely limits control options at this site. Flows from the area would most probably be conveyed northerly to Islais Creek via tunnel, although pump station/force main conveyance is a possibility. Upstream (westerly of the freeway) interception of the Sunnydale flows is another possibility though this option will necessitate separate interception for the Harney Way area.

Islais Creek Pump Station

This facility will be the focus of the Bayside wet-weather system. It will also provide pumping of the dry-weather flow from the Sunnydale/Yosemite area to the Southeast Plant and pumping of the treated effluent from the Southeast Plant into the Cross-town Tunnel for conveyance to the headworks of the Ocean Outfall. The Southwest Facilities Plan recommended a 320 (wet-weather) mgd pumping rate for an eight overflow per year frequency and a 400 (wet-weather) mgd pumping rate for overflow frequencies of four or less per year. The estimated cost difference between the two alternatives sizes is only about \$2.3 million (\$30.3 million versus \$32.6 million). Therefore, we are considering this cost as independent of the overflow frequency issue and have not included it in the cost matrix or cost-benefit analysis.

Cross-town Tunnel

This facility will convey wet-weather flow from the Islais Creek Pump Plant to the Southwest Water Pollution Control Plant (SWWPCP) for treatment and convey treated effluent (in a separate compartment) to the Ocean Outfall headworks. In addition, lines may be placed within the tunnel, or in a parallel utility tunnel, to convey sludge from the SWWPCP to the Southeast Plant for processing. The tunnel may also contain chemical transfer lines to convey treatment chemicals from the railroad to the proposed Southwest Treatment Plant. The Southwest Facilities Plan recommended the equivalent of a 13' diameter tunnel for the 8 overflow control level and the equivalent of a 14' diameter tunnel for more restrictive levels. The wet-weather costs are estimated at $143 million for the 13' diameter and $152 million for the 14' diameter. We favor the larger diameter tunnel and therefore are regarding this cost as constant and excluding it from the cost-benefit analysis.

Accelerated Program

Previously impounded Federal funds were released in early 1975 and almost simultaneously an accelerated program for pollution control facilities was announced by the Governor and the State Water Resources Control Board for the dual purpose of reducing pollution and providing construction employment during a period of high unemployment in this industry. The City immediately organized a crash program to construct pollution control facilities which included the following Bayside Facilities:

Bayside Outfall Consolidation Projects

Under Construction

Contract No.	Name	Contract Price* ($ Millions)	Estimated Completion Date
C-1	Channel O.C.-Berry St.	8.9	July 79
C-2	Channel O.C.-King St.	4.7	comp.Oct. 78
C-3	Channel O.C.-So. Embarcadero	8.1	Nov. 79
C-4	Channel O.C.-So. Side	3.7	Sept.79
IC-1	Islais Creek O.C.-South	7.1	Sept.79

*Bid price

Table VII-1

COST COMPARISON

BAYSIDE WET-WEATHER ALTERNATIVES

Overflows Per Year (5)		Bayside Wet-Weather Facilities (6)				Total Capital Costs ($ x 10^6)	Annual Costs ($ x 10^6)				
		Transport/Storage (6)		Treatment (1)			Transport/Storage		Treatment (pro-rata)		Total
North of Hunters Point	South of Hunters Point	Size (Mgal)	Cap. Costs ($ x 10^6)	Size (Mgd)	Cap. Costs ($ x 10^6)		Ammortization	O & M	Ammortization	O & M	Annual
16	16	75 (2)	178	185 (2)	91	276	13.01	0.10	7.45	0.61	21.2
8	8	75	178	265	115	293	13.01	0.10	9.42	0.81	23.3
4	4	120	230	345	139	369	16.81	0.16	11.38	1.00	29.4
1	1	202 (3)	325	345	139	465	23.75	0.26	11.38	1.00	36.4
10	1	75	183	265	115	298	13.37	0.10	9.42	0.81	23.7
8	4	85	191	265	115	306	13.96	0.11	9.42	0.81	24.3
8	1	100	206	265	115	321	15.05	0.13	9.42	0.81	25.4
4	1	125	242	345	139	381	17.68	0.16	11.38	0.80	30.0
8	0.2	-	242	265	115	357	17.68	0.14	9.42	0.80	28.0

(1) Size is the size attributable to Bayside Costs pro-rated on the basis of Bayside size/Total size.

(2) Adapted from M & E Alternate #11 WW size of SWWPCP = 320 MGD.

(3) Adapted from M & E Alt. #3 - Storage size & Costs adjusted for additional 33 MGD available for Bayside.

(4) Adapted from M & E Alt. #15

(5) Includes projects under construction.

(6) Excludes Islais Creek P. S. and the East-West Crosstown Tunnel.

Table VII-2

SECTION VIII COST-BENEFIT ANALYSIS

Introduction

The policies of the Environmental Protection Agency (EPA) on the planning, financing and regulation of combined sewer overflows (CSOs) are given in the 1975 policy statement on the implementation of PL-92-500 requirements and their Program Requirements Memorandum #75-34 - (originally issued in 1975 as Program Guidance Memorandum 61). (The pertinent portion of 1975 policy statement and the entirety of PRM #75-34 are reproduced in Appendix D). The policy statement recognizes that the problems presented by CSOs may range from very minimal to severe, states that in certain cases control of CSOs may be unwarranted and further states that EPA will hold in abeyance the setting of uniform effluent standards for overflows. PRM #75-34 expands the guidance provided in the policy statement into rigid planning and funding policy and approval criteria for the control of CSOs .

The stated purpose of the Memorandum is "to assure that projects are funded only when careful planning has demonstrated they are cost-effective". This Memorandum imposes four planning requirements and four criteria for project approval summarized as follows:

Planning Considerations

"Alternative control techniques which might be utilized to attain various levels of pollution control (related to alternative beneficial uses, if appropriate) ..."

"The costs of achieving various levels of pollution control by each of the techniques appearing to be most feasible and cost effective after the preliminary analysis."

"The benefits to the receiving waters of a range of pollution control during wet-weather conditions"....

"The costs and benefits of addition of advanced waste treatment process to dry weather flows in the area".

Criteria for Project Approval

"The final alternative selected shall meet the following criteria:

1. The analysis required above has demonstrated that the level of pollution control provided will be necessary to protect a beneficial use of the receiving water even after technology based standards required by Section 301 of P.L. 92-500 are achieved by industrial point sources and at least secondary treatment is achieved for dry-weather municipal flows in the area.

2. Provision has already been made for funding of secondary treatment of dry-weather flows in the area.

3. The pollution control technique proposed for combined sewer overflow is a more cost-effective means of protecting the beneficial use of the receiving waters

than other combined sewer pollution control techniques and the addition of treatment higher than secondary treatment for dry-weather municipal flows in the area.

4. The marginal costs are not substantial compared to marginal benefits."

"Marginal costs and benefits for each alternative may be displayed graphically to assist with determining a project's acceptability under this criterion. Dollar costs should be compared with quantified pollution reduction and water quality improvements. A descriptive narrative should also be included analyzing monetary, social and environmental costs compared to benefits, particularly the significance of the beneficial uses to be protected by the project."

The cost-benefit analysis contained in the following discussion follows the intent of these EPA planning guidelines and approval criteria.

Cost-Benefit Analysis

The Memorandum requires consideration of the provision of advanced waste treatment (AWT) for dry-weather flows as an alternative to providing CSO control as well as the consideration of 'alternative control techniques': These two alternatives do not appear cost-effective for the following reasons:

AWT is most frequently justified for discharges into inland waters where eutrophication may be a problem or in certain other cases where there are serious receiving water problems that are correctable by AWT. Eutrophication does not appear to be a problem in the Central Bay nor does this portion of the Bay have other year-round water quality problems such as excessive levels of heavy metals or pesticides. For these reasons provision of AWT for dry-weather flows would not appear justified.

The interpretation of 'alternative control techniques' is uncertain. If the 'alternative control techniques' refers to non-structural solutions such as improved street sweeping, litter control, sewer flushing etc. then 'alternative control techniques' would provide little in the way of improvement as the non-structural solutions would do little to abate the most significant local CSO problems of elevated coliform levels and the sludge deposits in Channel and Islais Creek. If 'alternative control techniques' primarily refers to the process selection and degree of treatment needed for the wet-weather plants, then our Facilities Planning for the Southwest Treatment plant has been fully responsive to this requirement. (The recommended wet-weather process(es) will be discussed in the project report for the Southwest Plant).

The 'benefits to the receiving waters of a range of levels of control during wet-weather' have been evaluated and will be discussed in the following sub-section on the recommended level of control.

Recommended Level of Control

Overflow control frequencies of 46 (no project), 16, 8, 4 and 1 per year have been evaluated and the results tabulated and graphically displayed in the accompanying Figures and Tables. Table VIII-1 provides statistical data on the minimum, average, and maximum number of overflows, hours of overflow, volumes of discharge, days of excessive coliform levels etc. It should be remembered that the nominal overflow frequencies correspond to average values; the actual number of overflows could range from less than half of the nominal frequency in very dry years to approximately double the nominal frequency in exceptionally wet years. Table VIII-2 provides data on the total sanitary flows and urban runoff generation and the percentage of each that will receive treatment under the various levels of control. Figure VIII-1 graphically compares project costs against both number of overflows per year and millions of gallons of untreated waste that would overflow per year.

The EPA Memorandum recommends that dollar costs be compared with 'quantified pollutant reduction and water quality improvements.' Table VIII-3 provides this comparison in terms of millions of gallons of discharge and pounds of BOD. Table VIII-5 compares costs with benefits in terms of percentage reduction from existing conditions and Table VIII-6 compares pollutants discharged to total loadings to the Bay Basin.

Incremental costs versus pounds of reduction for other pollutants would be roughly proportional to the incremental cost per million gallons of discharge as we are using the conservative assumption that the concentrations of various pollutants in controlled overflows will not change. As indicated in Section IV this may be a conservative assumption as the average concentration of certain constituents (floatables, settleables, perhaps particulate metal(s) may be less in future overflows. These possible reductions in pollutant concentrations cannot be included in the cost-benefit analysis as there is no way to reasonably predict the magnitude of such changes.

Other than evaluating the costs per day for recreational usage no costs versus benefit comparison can be made. We cannot, for example, assign a price tag to the benefit of reduced floatables or other esthetic considerations because these are highly subjective considerations nor can we assign an economic value to increases in the diversity and the abundance of marine life as there is no way to predict what, if any, increases may result from controlling CSOs. Admittedly, our data base on marine resources is incomplete. Even if we had an exhaustive data base it would be unlikely that we or anyone else could predict, with any certainty, the benefits to the marine life that would accrue from the control of CSO.

It is assumed that there would be some improvement in the marine resources resulting from control of overflows but how much is unknown. We note with interest that one of Seattle's justifications for controlling CSOs into Lake Washington was improvements to fish rearing and spawning. This justification for funding of CSO control was rejected by EPA Region X on the grounds that Seattle could not substantiate such a claim (Warburton-1978).

As a series of EPA sponsored Technology Transfer Seminars held in 1978, the 'knee of the curve' concept for cost-benefit analysis was extensively discussed. This concept is to provide funding up to the point on the cost-benefit curve that the marginal costs start increasing dramatically when compared with marginal benefits. As indicated in Table VIII-3 the marginal cost per overflow (based on equivalent annual costs) is approximately $707,000 as one goes from the existing condition of 46 per year to 16 per year, the costs drop substantially to $325,000 per overflow between 16 and 8 per year but then jump dramatically to $1,400,000 per overflow between 8 and 4 per year and continue to increase to $2,300,000 per overflow as overflows are further reduced to one per year. The curves on Figure VIII-1 definitely show 'knees' at the 8 overflow control level.

The apparent violation of the classic 'law of diminishing returns' that occurs between the existing level of 46 per year and 16 per year results from the need to provide transport facilities to interconnect all of the Bayside elements in order that treatment may be efficiently provided at a single treatment plant. These transport facilities are required regardless of control frequency. There are certain minimum sizes for transport facilities, especially tunnels, below which little or no cost savings results. The storage volume inherit in these economical minimum size transport facilities approximates the volume needed for the 16 overflow per year level. Most of the additional storage for the 8 overflow per year level can be provided by a modest and very economical increase in the transport facilities hence the relatively small incremental costs between 16 and 8 overflows per year. The additional volumes needed to go to control levels lower than 8 per year start to increase significantly and it no longer is economical to provide the additional volume by oversized transport facilities, especially in the tunnels. Hence the significant increase in incremental costs below the eight overflow level.

Alternative Project to Provide Additional Protection to Shellfish Beds

Recognizing the possible health risks to shellfishers, the desire on the part of both the SWRCB and RWQCB, to reestablish commercial shellfishing in the Bay, and the rigid cost-benefit constraints imposed by the Federal guidelines; we have explored the possibility of providing additional protection to the shellfishing areas while staying within the rigorous cost-benefit requirements of these guidelines.

The bulk of the sport shellfish resource lies south of the Hunters Point peninsula. The only areas suitable for commercial shellfishing or mariculture also lie south of Hunters Point. This peninsula provides a natural break in Bay current circulation and would serve to protect nearshore areas south of this peninsula from the influence of overflows originating from the north of the peninsula. Therefore, a break in overflow frequencies at this location would be logical if there are circumstances, such as shellfish beds, that warranted a higher degree of protection.

A protection to one overflow per year for the shellfish beds could be provided for an additional $5,000,000 over the 'knee of curve' level of 8 per year, if the control level north of Hunters Point were increased to 10 overflows per year. The question is then; do the benefits in terms of both potential commercial shellfishing and recreational clamming outweigh the additional cost and increased mass emissions associated with this alternative?

A cost-benefit analysis based on commercial shellfishing may not be warranted for two reasons: (1) it has not been established that the area impacted by overflows is, in fact, suitable for commercial shellfishing, due to other reasons (i.e. dredging for clams is prohibited, oysters may not be suitable for this area due to inadequate growth rates, and conflicts with recreational usages) and (2) even if there were no combined sewer overflows, commercial harvesting would probably have to be suspended following significant rainfall or purification techniques used such as relaying or depuration. In summary, combined sewer overflows may not be the controlling factor relative to the economic viability of commercial shellfishing or mariculture in this area.

It is true that clams are recreationally harvested in this area year- round and that overflows may constitute a greater potential health risk than urban runoff to consumers of clams harvested from this area. Therefore, a cost-benefit analysis on this aspect of the problem appears reasonable.

There is considerable uncertainty as to the appropriate post-overflow quarantine period as little is known about viral and bacteriological depuration rates of shellfish in their natural environment. For the purposes of this cost-benefit analysis, we have assumed 30 days as being a reasonable quarantine period.

The number of days that shellfish beds should be quarantined under various overflow control frequencies is given in Table VIII-4. The quarantine days include days within the May to October statewide PSP quarantine as this quarantine is advisory only with respect to Bay clams. The computation of quarantine days considers only wet-weather overflows from San Francisco, i.e., other sources of coliform contamination are ignored. For the 8 overflow control level the beds would be quarantined 120 days due to overflows. Reduction in overflows to 1 per year would reduce the average quarantine period to 24 days per year; a difference of 96 days per year.

However, there are only 5 days every fortnight with low tides (less than 0.2 ft. above MLLW) suitable for shellfishing on the average. Approximately half of these wintertime lower-low waters will occur during hours of darkness and would not be suitable for shell-fishing. Therefore, one overflow per year control will provide only 17 additional clamming days per year compared to the eight overflow control.

The ESA survey found an average of about 3 people clamming for food during each of their very low tide surveys. Since they may have missed some clammers, we are assuming 6 people per low tide day. The $5,000,000 additional capital cost is equivalent to about $360,000 as equivalent annual costs. This cost difference amounts to approximately $3,500 per clammer per day, a cost per beneficiary that may exceed the EPA 'marginal costs and is not substantial when compared to marginal benefits' criteria.

The overall Bayside mass emissions for this alternative control level would be approximately 15% higher than the mass emissions for the single control level of eight overflows per year. However, this increase in mass emissions would be inconsequential when compared with total emissions into the Bay. For example the difference in total heavy metal loadings would amount to approximately 0.02% of the total heavy metals discharged into San Francisco Bay.

BAYSIDE

STATISTICAL SUMMARY WET-WEATHER OVERFLOWS

CONTROL LEVELS

Yearly O'flow Totals	Unit	Existing Min	Existing Ave	Existing Max	16 per year Min	16 per year Ave	16 per year Max
No. of Overflows	Event	17	46	77	5	16	32
% Reduction			Base			65	
Hours of Overflow	Hour	157	381	671	15	86	179
% Reduction			Base				
Total Wastewater	Gal.x10^6	1,240	4,220	7,610	185	1,540	3,410
% Reduction			Base			64	
Sanitary Discharge	Gal.x10^6	410	990	1,730	39	230	460
% Reduction			Base			77	
Urban Runoff	Gal.x10^6	830	3,230	5,880	146	1,280	2,950
% Reduction			Base			59	
Composition of Discharge (% Sanitary)	%		23			15	
Days Receiving Wastes (near outfalls) coliform levels exceed:							
(1) 10,000 MPN/100 ml	Days	34	60	97	9	24	45
% Reduction			Base			60	
(2) 1,000 MPN/100 ml	Days	66	104	135	20	45	85
			Base			57	
BOD_5	lbs.x10^3	1,240	4,230	7,620	186	1,550	3,420
% Reduction			Base			63	
Suspended Solids	lbs.x10^3	2,590	8,810	15,900	386	3,210	7,110
% Reduction			Base			64	

Table VIII-1

BAYSIDE

STATISTICAL SUMMARY WET-WEATHER OVERFLOWS

(continued)

CONTROL LEVELS

Yearly O'flow Totals	Unit	8 per year Min	8 per year Ave	8 per year Max	4 per year Min	4 per year Ave	4 per year Max	1 per year Min	1 per year Ave	1 per year Max
No. of Overflows	Event	1	8	20	0	4	12	0	1	3
% Reduction			82			91			97.8	
Hours of Overflow	Hour	2	31	76	0	14	42	0	4	24
% Reduction			92			96.3			99.0	
Total Wastewater	Gal.x10^6	12	615	1,490	0	292	819	0	81	433
% Reduction			85			93			98.1	
Sanitary Discharge	Gal.x10^6	5.2	81	200	0	37	109	0	10	62
% Reduction			92			96.3			99.0	
Urban Runoff	Gal.x10^6	6.8	534	1,290	0	255	710	0	70	371
% Reduction			83			92			97.8	
Composition of Discharge (% Sanitary)	%		13			13			12	
Days Receiving Wastes (near outfalls) coliform levels exceed:										
(1) 10,000 MPN/100 ml	Days	2	11	28	0	6	17	0	1	6
% Reduction			82			90			98.3	
(2) 1,000 MPN/100 ml	Days	4	24	51	0	13	34	0	3	11
% Reduction			77			88			97.1	
BOD_5	lbs.x10^3	12	616	1,490	0	292	820	0	81	434
% Reduction			85			93			98.1	
Suspended Solids	lbs.x10^3	25	1,290	3,100	0	609	1,710	0	169	903
% Reduction			84			925			98.1	

BAYSIDE ZONE

WASTEWATER GENERATED AND PERCENTAGE TREATED

	Generated (Mill. Gal./Yr)	Percentage Treated				
		Existing	16 O'flows	8 O'flows	4 O'flows	1 O'flows
Sanitary	22,280	95.56	98.97	99.64	99.83	99.96
Urban Runoff	5,270	38.7	75.7	89.87	95.16	98.67
Total Wastewater	27,550	84.68	94.52	97.77	98.94	99.71

Table VIII-2

MARGINAL COSTS FOR

CONTROLLING OVERFLOWS

Overflow Frequency	Equivalent Annual Costs* $\$ \times 10^6$	Cost Difference $\$ \times 10^6$	Costs per Overflow	Cost per Mgal	Cost per Pound BOD	Cost per Additional Day of Body Contact Recreation
46	0					
		21.2	$ 707,000	$ 7,910	$ 8.66	$359,000
16	21.2					
		2.6	325,000	2,810	2.25	124,000
8	23.8					
		5.6	1,400,000	17,340	18.82	509,000
4	29.4					
		7.0	2,333,000	33,180	33.18	700,000
1	36.4					

Table VIII-3

STATISTICAL SUMMARY WET-WEATHER OVERFLOWS

YOSEMITE-SUNNYDALE AREA

CONTROL LEVELS

Yearly O'flow Totals	Unit	Existing			16 per year		
		Min	Ave	Max	Min	Ave	Max
No. of Overflows	Event	17	46	77	5	16	32
% Reduction			Base			65	
Hours of Overflow	Hour	157	381	671	13	86	179
% Reduction			Base				
Total Wastewater	$Gal.x10^6$	191	637	1,140	26	225	498
% Reduction			Base			65	
Sanitary Discharge	$Gal.x10^6$	63	154	270	5.3	35	72
% Reduction			Base			77	
Urban Runoff	$Gal.x10^6$	128	483	870	20.7	190	426
% Reduction			Base			61	
Composition of Discharge (% Sanitary)	%		24			16	
Quarantine days - shellfish beds due to overflow*	Days	171	257	324	83	171	251
% Reduction			Base			33	
BOD_5	$lbs.x10^3$	192	640	1,140	186	226	500
% Reduction			Base			65	
Suspended Solids	$lbs.x10^3$	399	1,329	2,380	54	469	1,040
% Reduction			Base			65	

*Includes days within the May to October PSP quarantine as that quarantine is advisory only for clams

Table VIII-4

STATISTICAL SUMMARY WET-WEATHER OVERFLOWS

YOSEMITE-SUNNYDALE AREA

(continued)

CONTROL LEVELS

Yearly O'flow Totals	Unit	8 per year			4 per year			1 per year		
		Min	Ave	Max	Min	Ave	Max	Min	Ave	Max
No. of Overflows	Event	1	8	20	0	4	12	0	1	3
% Reduction			82			91			97.8	
Hours of Overflow	Hour	2	31	77	0	16	44	0	3	16
% Reduction			92			96.3			99.0	
Total Wastewater	Gal.x10^6	2	93	225	0	49	134	0	10	60
% Reduction			85			92			98.4	
Sanitary Discharge	Gal.x10^6	.8	12.5	31	0	6.5	18	0	1.2	6.5
% Reduction			92			95.5			99.2	
Urban Runoff	Gal.x10^6	1.2	80.5	46	0	42.5	26	0	8.8	53.5
% Reduction			83			91			98.2	
Composition of Discharge (% Sanitary)	%		13			13			12	
Quarantine days - shellfish beds due to overflow*	Days	60	120	210	0	76	201	0	24	90
% Reduction			53			70			91	
BOD_5	lbs.x10^3	2	93	226	0	49	134	0	10	60
% Reduction			85			92			98.4	
Suspended Solids	lbs.x10^3	4	194	469	0	102	280	0	21	125
% Reduction			85			92			98.1	

*Includes days within the May to October PSP quarantine as that quarantine is advisory only for clams

Table VIII-4

SUMMARY COST-BENEFIT COMPARISONS

# OF OVERFLOWS		CAPITAL COSTS $\$ \times 10^6$	HOURS OF OVERFLOW	BENEFITS (% REDUCTION FROM EXISTING)*			
NORTH OF HUNTERS POINT	SOUTH OF HUNTERS POINT			O'FLOW VOLUME	TOTAL HEAVY METALS***	DAYS WITH MPN 1000**	SHELLFISH QUARANTINE DAYS**
16	16	276	77	64	64	57	33
8	8	293	92	85	85	77	53
4	4	369	96	93	93	88	70
1	1	465	99	98	98	97	91
10	1	298	88/99	83	83	97	91
8	4	306	92/92	86.5	86.5	88	70
8	1	321	92/99	87.4	87.4	97	91
8	0.2	357	92/99.8	87.6	87.6	99.4	97.7
4	1	381	97/99	91	91	97	91

*Percentage reduction in other pollutants (e.g. BOD_5 etc.) will approximate the percentage reduction in volume.

**South of Hunters Point only
Shellfish quarantine days does not consider closure due to other reasons (e.g. runoff, PSP)

***Includes cadmium, chromium, copper, mercury, lead and zinc.

Table VIII-5

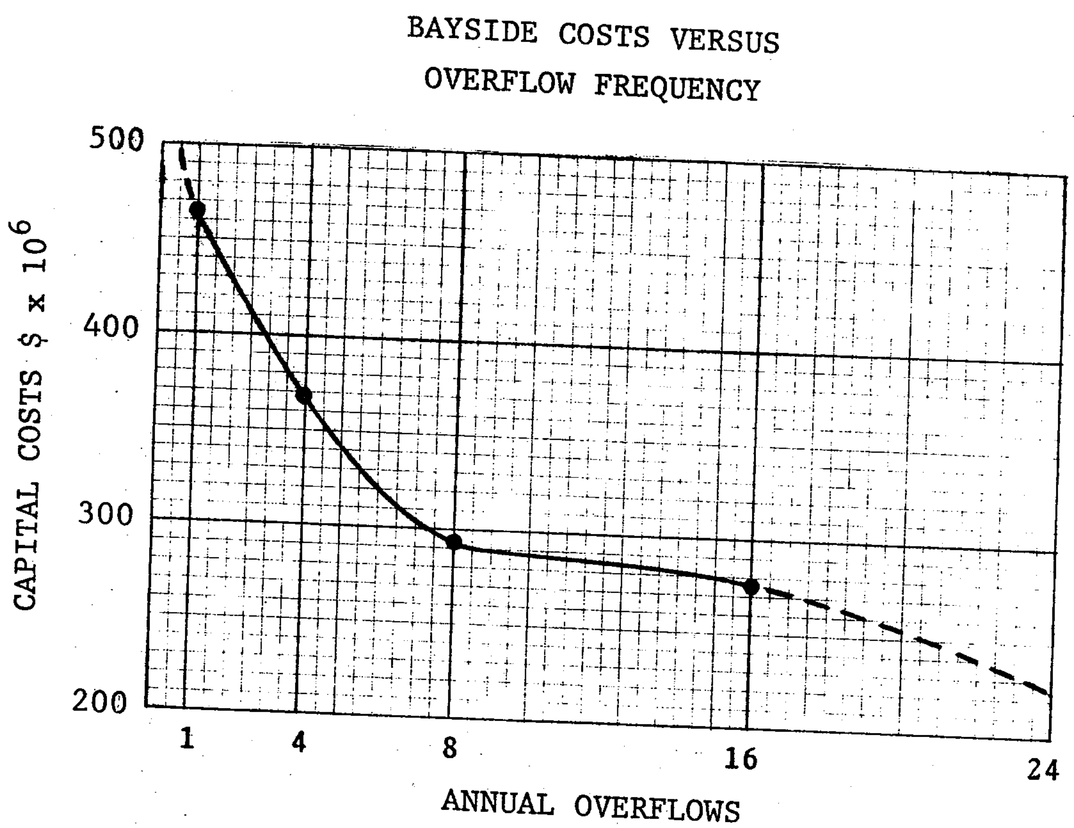
BAYSIDE OVERFLOW LOADINGS

COMPARED TO TOTAL BASIN LOADINGS**

No/Overflows		TSS		BOD_5		N		THM*	
N/Hunters Point	S/Hunters Point	lbs.x10^6	% Total	lbs.x10^6	% Total	lbs. x 10^3	% Total	lbs. x 10^3	% Total
46	46	8.80	0.20%	4.22	7.6%	141	0.16%	88.0	1.01%
16	16	3.21	0.074%	1.54	1.6%	51.4	0.057%	32.1	0.37%
8	8	1.28	0.029%	0.62	0.66%	20.5	0.023%	12.8	0.15%
4	4	0.61	0.014%	0.29	0.31%	9.7	0.011%	6.09	0.070%
1	1	0.17	0.004%	0.08	0.09%	2.7	0.003%	1.69	0.019%
10	1	1.49	0.034%	0.71	0.76%	23.8	0.026%	14.9	0.17%
8	4	1.19	0.027%	0.57	0.61%	19.1	0.021%	11.9	0.14%
8	1	1.11	0.026%	0.53	0.56%	17.8	0.020%	11.1	0.13%
4	1	0.52	0.012%	0.25	0.27%	8.4	0.009%	5.28	0.06%

* Total Heavy Metals, includes Cd, Cr, Cu, Hg, Pb, & Zn.
** Data Sources - Basin Plan, ABAG EMP (1978) ABAG Surface Runoff Modeling (1978)

Table VIII-6



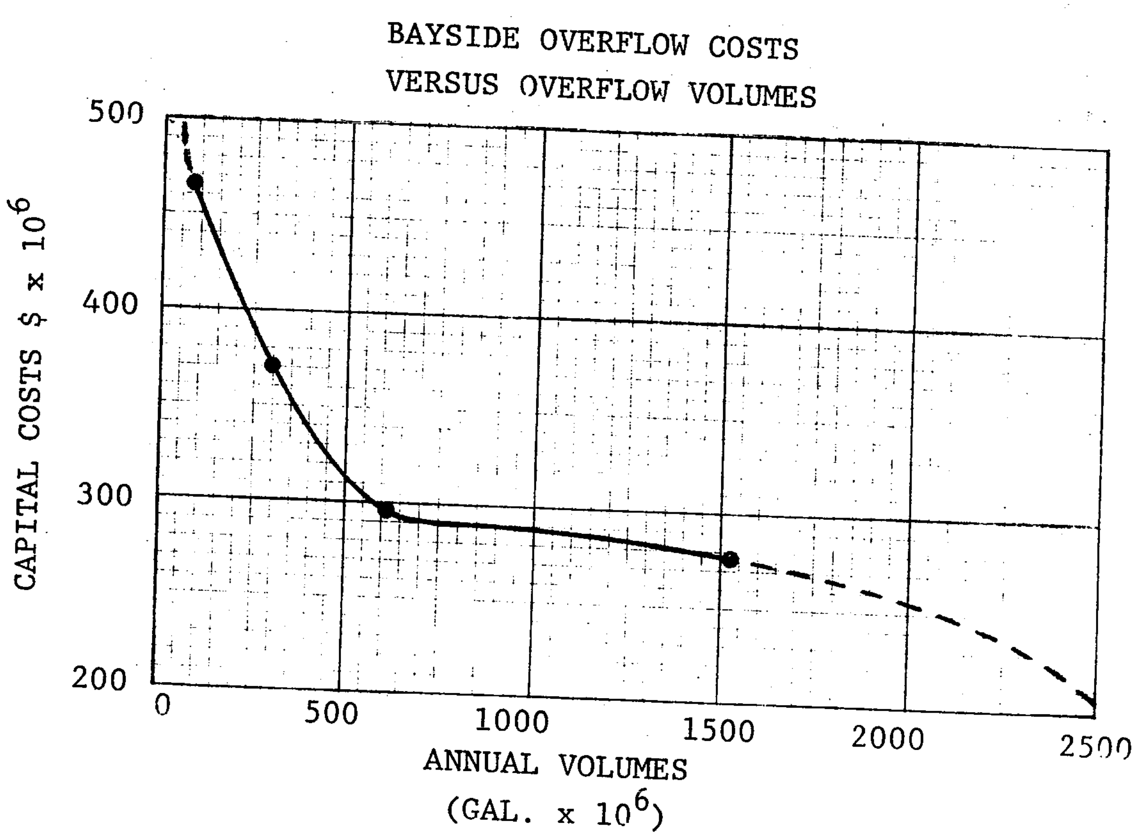


Figure VIII-1

IX. DISCHARGE PROHIBITIONS

The Basin Plan discussion of the San Francisco combined sewer overflow problem concludes with the recommendations that all overflows be discharged through outfalls designed to achieve an initial dilution of 10:1 and that;"Removal of such overflow locations from dead-end sloughs and channels, and from close proximity to beaches and marinas is especially desirable". The present NPDES permits mandate the Basin Plan recommendations for the 10:1 initial dilution and removal of discharges from dead-end sloughs. However, both the Basin Plan and the NPDES permits contain clauses to the effect that exceptions to these discharge prohibitions will be considered where the cost to comply is inordinate compared to the expected benefits "and when an equivalent level of environmental protection can be provided by alternate means". We are requesting exceptions to these two discharge prohibitions based on the following considerations.

Discharge to the Head-end of Dead-End Sloughs

The apparent rationale for this Basin Plan recommendation is to avoid areas "where local currents or confinement will result in accumulations of floatable material". Westerly winds predominate in San Francisco. This fact coupled with the generalized tidal current circulation of estuaries and sloughs (i.e. new water comes in on the bottom during flood tide; old water moves out from the top during ebb tides) would result in little accumulations of floatable material in the three 'dead-end' slough areas of Bayside. The only accumulations of overflow floatables that were noted during the 1979 survey are within the emergency relief channels of the Marine, Division, Selby and Sunnydale structures during or shortly after an overflow. However reports of overflow floatables persisting for a few days after cessation of overflows have been received from the house boat dwellers in Channel. They indicated that this is most noticeable generally following the debris laden early season overflows.

As noted in Section IV sludge deposits exist at the head-ends of Islais Creek and Channel. These blankets are presumably caused by overflows, but there may be other sources of organic material in these areas as noted earlier. A reduction in overflow frequency to 8 per year will affect an 85% reduction in the amount of organic material discharged during overflows. This reduction in organic loadings should result in a comparable reduction in the sludge deposits, assuming that the overflows are the dominant cause of the deposits.

Black, anoxic mud, smelling of hydrogen sulfide is found in the Yosemite Canal/South basin area, the third confined area on Bayside. It is impossible to quantify the extent that overflows contribute to these conditions, as these conditions are common to intertidal embayments and salt marshes in relatively unpolluted areas and could be the result of purely natural phenomena, i.e. decaying cord grass, pickleweed, etc. Overflow debris, if present, would be difficult to identify in this area due to the ubiquitous presence of garbage and other waste materials that have been dumped in this area over the years.

Costs to completely remove the existing overflow structures from these confined areas to open shoreline locations are approximately:

Location	Costs
Channel	$ 36,000,000
Islais Creek	$ 11,000,000
Yosemite Canal	$ 9,000,000

Construction of the conveyance needed to relocate the Channel discharges could entail significant disruptions to traffic and access, as the available routes follow City streets. Construction of the Islais Creek relocations would interfere with maritime activities, if a shoreline route is selected or incur right-of-way costs, not included in the above estimates, if an inland route is used. Either option could meet with considerable objection from the Port Authority (a fully autonomous City agency), as the presence of the sewer could serve to limit Port Authority options in redeveloping this area.(1) The only feasible routes for the Yosemite relocation would traverse the Candlestick State Recreation Area. Whether such a proposal would be acceptable to the State is unknown.

Based on the high cost to comply and the fact that the reduction in yearly overflow frequency to the recommended eight per year will provide a substantial reduction in both the floatable problem and sludge problem, we conclude that exceptions to this discharge prohibition are warranted. The baffling of the discharge structures and the fact, that under controlled conditions the heavily debris laden early season storms will be fully contained during most years, will result in a further lessening of the floatable problem.

<u>10:1 Minimum Initial Dilution</u>

"The water quality recommendations require an initial dilution of 10:1. The purpose of that objective is to minimize the aesthetic effects of any discharge, especially that of untreated or partially treated overflows" (Basin Plan 1975). Esthetic effects could be either the discolored turbid appearance of the field caused by fine suspended solids, and to a lesser

(1) The State legislation transferring the authority of the Port to San Francisco provides for full autonomy of the Port.

extent, by oil and grease or a degradation in the appearance of the shoreline as a result of macroscopic sewage solids that wash ashore. Overflows are generally more turbid than the background Bay turbidity and small (12"by 18" typical) wisp-like oil slicks can be seen under close observation. The color line marking the edge of the overflow field may be visible to observers in a boat and probably would be visible to an observer flying directly overhead (but below the clouds) in a plane or helicopter. This discoloration may persist for up to one-half tidal cycle (12½ hours) following cessation of the overflow. It should be remembered that overflows will only occur during rainstorms and typically, under controlled conditions, terminate during the later phase of the rainstorm or at worse a few hours after the rainfall has ceased. Most of these overflows will be occurring during December, January, February and March, months that average 12.3 hours of darkness per day (1/2 hour before sunrise to 1/2 hour after sunset). Therefore, it is not expected that many people will be in position to observe the receiving water discoloration caused by overflows. It should also be noted that the discoloration of the Bay resulting from delta outflow is clearly visible in both low level aerial photographs (Brown & Caldwell 1971) and Skylab 4 manned spacedraft photographs taken from an altitude of 273 miles (NASA 1974).

The amount of shoreline deposition of floatables is a function of winds and tidal currents, not of initial dilution. Offshore winds will carry floatables away from nearshore waters; on shore winds may bring offshore floatables ashore. Prevailing winds in this area are westerly, and offshore with respect to the Bay shoreline.

In addition to esthetic concerns one possible advantage of high initial dilution could be a lessened potential for acute toxic effects. As noted earlier overflows generally display low acute toxicity as measured by standard 96-hour static bioassays and the duration of highly concentrated overflow field even in confined areas is typically less than 24 hours. It is problematical whether the 10:1 initial dilution achievable by extended outfalls would result in a measurable reduction in the number of marine organisms displaying toxic effects as a result of overflows.

Sizes, lengths and preliminary costs for the extended outfalls needed to meet the 10:1 dilution criteria are as follows:

Location	Sizes (dia.)	Length*	Costs $\$x10^6$
Channel	2 @ 18'	7460	$44.1
Islais Creek	2 @ 17'	2800	$19.1
Yosemite	1 @ 11'3"	6060	$12.8

*Includes diffuser

These designs will provide sufficient capacity to carry all but the peak hour per year overflow rate. That is, under this proposal some shoreline discharge would occur on the average of one hour per year. Costs to provide for the peak 5 year rate were not evaluated as it was immediately apparent that provision for such extreme rates would be beyond the realm of feasibility.

These costs are for gravity flow options based on a preliminary evaluation of the available hydraulic head. A detailed engineering evaluation of the available hydraulic head would be required to confirm the feasibility of gravity flow. These estimates are based on March 1979 costs and do not include the costs of onshore construction, engineering, field studies, or contract administration. (See Appendix F).

There may be environmental disadvantages to extended outfalls. During periods of high delta outflow a very high density stratification (8 sigma units or more) can occur. A submerged discharge during these conditions would remain submerged resulting in greater potential impact on benthic organisms and greatly increased probability that the waste field would be carried into the more sensitive waters in the South Bay, whereas, a surface field remain surfaced and will generally proceed seaward towards the Golden Gate.

Other disadvantages of extended outfalls include the potential for disruptions to maritime traffic during construction (Channel and Islais Creek), a very real potential for damage from dragging anchors or dredging activities, and potential problems of loss of capacity due to siltation or marine biofouling organisms.

Because of the very high initial costs, the potential for considerable costs for repairs and maintenance, the paucity of evidence that such costs are essential to protect and enhance the beneficial uses of the nearshore receiving waters and the possibility that under stratified conditions extended outfalls could be a disadvantage we conclude that the costs of extended outfalls are inordinate compared to the benefits derived and an exception to this discharge prohibition is in order.

SECTION X

POSSIBLE MEASURES TO MITIGATE THE ADVERSE IMPACTS OF OVERFLOWS ON THE RECREATIONAL USE OF THE RECEIVING WATERS

Four possible measures to mitigate the adverse impacts of overflows on recreational use of the receiving waters are:

Baffling of overflows to reduce floatables

Screening of overflows

Disinfection of overflows

Posting of recreational areas and shellfish beds

Our preliminary analysis of the costs, merits, and operational aspects of these measures is as follows:

Baffling and Screening of Floatables

Floatable solids in combined sewer flows that could degrade the appearance of shoreline if washed ashore include: rags, fecal material, toilet tissue, paper towels, plastic and rubber goods, dead rats, candy and cigarette wrappers, and cigarette filter tips. In addition to these solids, combined sewage flows will contain a considerable quantity of natural material, including leaves and twigs. Therefore, the feasibility of providing baffling and screening (bar racks, fixed and mechanically cleaned and Roto-strainers) was examined.

Baffling

Much of the above listed material may float to the surface in the consolidation structures and could be trapped by a suspended baffle extending several feet below the water surface. A series of physical model tests were run to evaluate the feasibility of baffling. These tests were run on a 1:48 scale model of the proposed Westside Transport Facility. These tests indicated that a well-designed baffling system could result in a 70% to 95% or more reduction in floatables discharged.

Because of the difference in geometric configuration between the Westside Transport and the Bayside Facilities, the direct extrapolation of these results to predict the performance of baffles in the Bayside system may not be valid. However, the Westside results are very encouraging and it is believed that a properly designed baffling system for the Bayside Facilities will achieve a significant reduction (50% or more) in floatables discharged. A conceptual drawing of a typical baffle is shown on Figure X-1. Costs to install the baffle walls will run about $150 per linear foot of baffle wall. Assuming a total of 15,000 feet of baffle wall required for Bayside, costs for baffling will be approximately $2,250,000. This appears to be cost-effective and the decision has been made to include this mitigating measure wherever feasible.

Screening

Because non-floatable or semi-floatable sewage solids could underflow a baffle, we have evaluated the feasibility of screening.

Roto-strainers (TM) were rejected from further consideration on the basis of very high costs, hydraulic head requirements (3 ft. typical), and uncertainties about their operational reliability under high intermittent operations. Mechanically cleaned treatment plant bar racks were rejected because of expense, uncertain operations, and vertical clearance problems under the streets or other areas of limited head room. Coarse fix racks, with clear spacing greater than one inch (1"), probably would have minimal potential for clogging. However, they would entrap little in the way of sewage solids. Racks fine enough to trap plastic goods (5/8") or cigarette filter tips (5/16") may be prone to serious clogging with a resultant loss of hydraulic capacity and the potential for upstream flooding of streets and basements. Post overflow cleaning by use of a shower-type wash-down system may be required to prevent odors being produced by entrapped organic material. There is a major concern as to whether the benefits derived will offset the costs (several million dollars for all locations) and potential for upstream flooding.

Because of the very real concern for flooding, we recommend that any decision on fixed racks be deferred until such time as the project is completed and the effectiveness of the baffling can be evaluated. If the baffled flow still contains substantial quantities of objectionable sewage solids, then a test installation of various-size bar racks could be retrofitted for evaluation.

Disinfection of Overflows

The feasibility of disinfection of overflows was first evaluated assuming the use of separate chlorine contact chambers. This approach was immediately rejected due to the excessive costs ($160 million for the contact basins needed to provide 30 minutes of contact time at the one-year overflow rate, $5 to $10 million for the chlorine tankage, piping, etc.). Consideration was then given to the use of the various transport/storage facilities as the chlorine contact basins. This analysis is based on the following assumptions:

1. There will be between 6 and 12 overflow structures remaining in operation after the completion of all of the Bayside Facilities.

2. The one-year overflow total rate from the Bayside Facilities (assuming 8 overflow per year design) will be approximately 5000 CFS.

3. Sodium hypochlorite is the only suitable chemical disinfectant. The Board of Supervisors has passed an ordinance against the continued use of liquid chlorine as a disinfectant due to the high safety risks of transporting and storing the chemical. We assume that this ordinance will apply to chlorine dioxide and other chemical disinfectants with comparable safety problems. Non-halogenous disinfectants (i.e. infra-red, ozone) have only been successful with high grade effluents and are probably not suited for overflows.

   Central hypochlorite storage facilities are assumed due to the multiplicity of outfall consolidation structures and the limited shelf-life of hypochlorite.

   Dechlorination would be required to neutralize the proven toxic effects of chlorine. Sodium bisulfite is assumed as the dechlorination agent.

Successful disinfection with sodium hypochlorite would be extremely difficult to achieve due to the following:

1. Disinfection chemicals must be on hand at all times to treat the "worst case" requiring year-round storage of large quantities of disinfectant. In the case of sodium hypochlorite, this chemical deteriorates with time, reducing its effectiveness and is not always commercially available on short term demand.

2. Disinfection dosage is usually controlled by wastewater flow rate and chlorine demand both of which will vary dramatically. In the course of an everflow, chlorine demand cannot be quickly determined and serious overdoses or underdoses may occur due to improper control. Both situations incur undesirable results: underdosing meaning inadequate disinfection and overdosing, release of toxic materials to the aquatic environment.

3. Dechlorination facilities require as careful design as chlorination facilities, and due to the lack of control of effluent flow, sodium bisulfite dosage could be subject to severe dosage control problems thereby negating its intended purpose i.e., eliminating chlorine residual.

4. In order to insure rapid initial mixing the hypochlorite injection would have to be injected into the tributary sewers several hundred feet upstream of the consolidation

structures. As there are over 20 tributary sewers to the Bayside structures, at least six miles of piping would be required from the central hypochlorite holding facilities.

5. The complexity of structures with their multiple entry and exit points would make it almost impossible to achieve the recommended 30 minute contact time at high overflow rates.

The performance of any such system to disinfect combined sewer flows is open to question. The fact that much of the flow would receive less than adequate contact time, coupled with difficulties in establishing proper dosage rate could result in very poor performance as far as kills of highly resistant viruses such as hepatities. Due to the uncertainties about the performance of this system, the considerable operational headaches attendant with the multiplicity of injection points, and the face that available public health statistics do not indicate that combined sewer overflows are presently a serious public health problem, it is our conclusion that disinfection is not a suitable mitigating measure.

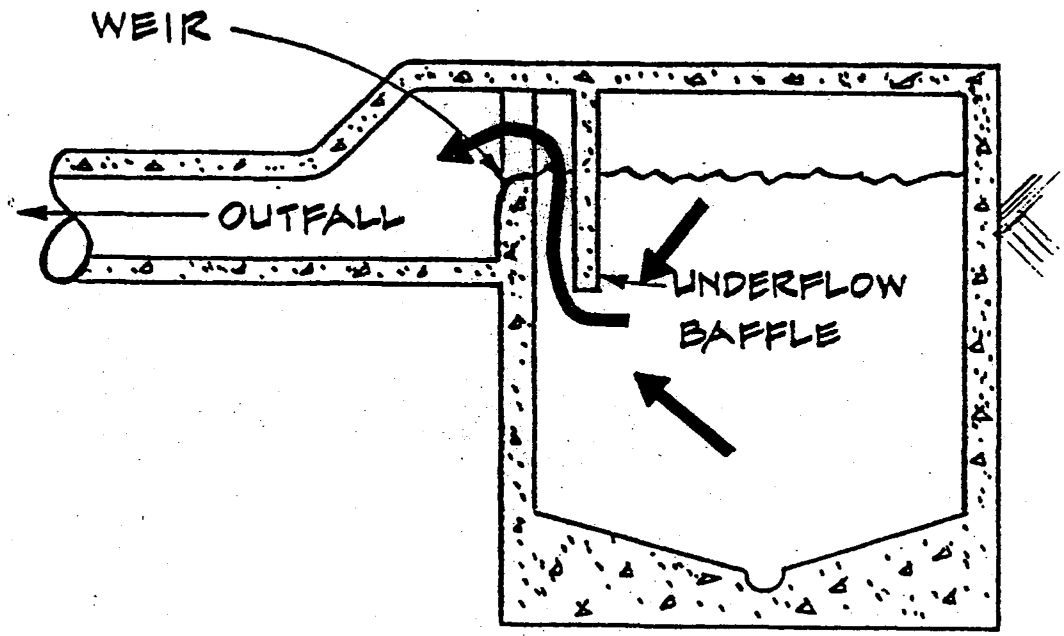
Posting of Recreational Areas and Shellfish Beds

The City Department of Public Health routinely monitors the receiving water coliform levels along the entire City shoreline and posts warning signs whenever coliform levels exceed the standards for body contact recreation. Only limited posting is done in the Bayside area as there are, at present, no suitable water contact areas in this zone. Shellfish beds have not generally been posted except for the required May to October dinoflagellate (red-tide) quarantine. Wintertime shellfishing is a sporadic activity and may have been unnoticed by the Health Department inspectors. Additionally, a portion of the shellfishing area impacted by overflows lies within San Mateo County.

We have advised our Health Department of the shellfishing activities in this impacted area, and have requested that they take the lead in establishing a program to post shellfish beds during periods of unacceptable water quality (See Appendix G). We have also advised the California Department of Parks & Recreation of the overflow problem and will work with them to develop an acceptable beach-posting program for the Candlestick Point State Recreation Area.

REPRESENTATIVE BAFFLE LAYOUT

NO SCALE



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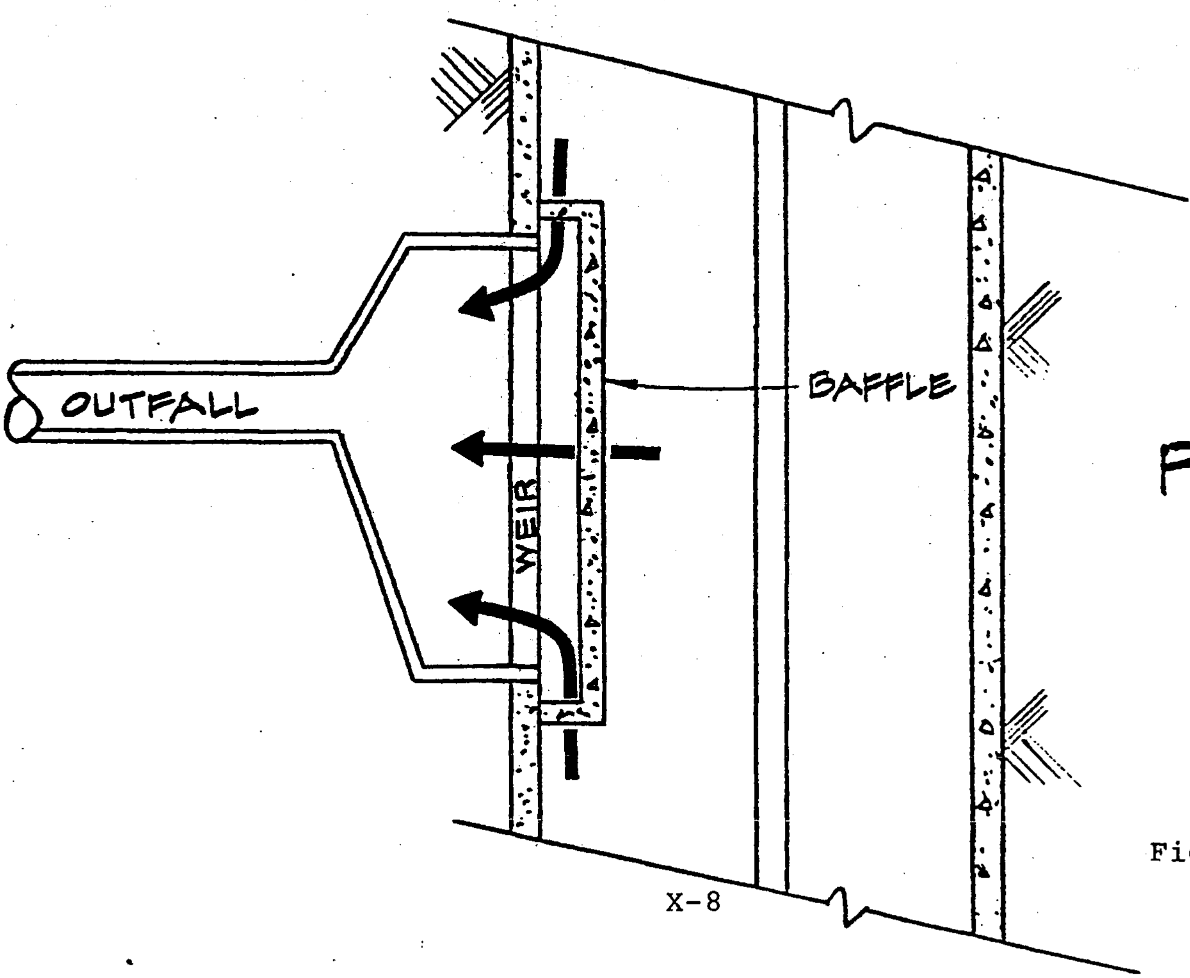


PLAN

Figure X-1

SECTION XI CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- Planning for the control of discharges from publicly owned treatment works consists of establishing the most cost-effective, and socially acceptable method of meeting the Congressionally mandated control standard, i.e. secondary treatment. Planning for combined sewer overflow (CSO) control differs in that there is no apparent Congressional mandates for control of all CSO discharges (EPA 1975). Congress did, however, specifically allow for the grant funding of CSO control projects in PL 92-500.

- Control of CSOs can be very expensive when compared to the benefits derived. For this reason the EPA has issued funding guidelines (PRM 75-34) which require a cost-benefit analysis in order to establish the proper level of control. The required benefits analysis should include both "quantified pollution reduction and water quality improvements".

- The quantified pollution reductions range from a 64% reduction for the 16 overflow per year control level to 98% reduction for the one overflow per year control level. A pronounced 'knee of the curve' occurs at the 8 overflow per year control level, a level that would achieve an 84% pollution reduction.

- Benefits in terms of improvements to the receiving water are difficult to quantify. The identifiable adverse impacts of overflows are sludge deposits in Islais Creek and Channel, occasional depressed dissolved oxygen levels in these same areas, localized and temporary adverse esthetics impacts, and temporary violations of receiving water bacteriological levels for swimming and shellfishing. There could also be some localized acute or chronic toxicity impacts to marine organisms but such impacts, if present, would be very difficult to quantify.

- Overflows are a local problem as opposed to a region wide problem. The adverse impacts of overflow would be very difficult to detect beyond a few miles from the structures. Under existing conditions, overflows from San Francisco contribute less than 2% of the total heavy metals discharged into the S.F. Bay Basin. Therefore even the complete elimination of overflows would not result in any measurable areawide reduction in background levels of these pollutants.

- The sludge deposits cover less than 0.02% of San Francisco Bay and may be in part a result of organic detritus from other point and non-point sources. Reduction in the number of overflows coupled with deposition within the transport/storage facilities should result in a significant but unquantifiable reduction in the sludge blanket problem.

- The esthetics problem is most acute in Channel particularly following the debris laden early season storms. Reduction in the number of overflows to the "knee of the curve" level of 8 overflows per year would achieve at least an 84% reduction in the yearly emissions of visual pollutants (floatable solids, oil and grease). Baffling of the overflows and the fact that the runoff from early season storms will be fully contained in most years, would further contribute to reduction of the esthetic impact problems.

- Receiving water coliform levels may exceed California Administrative Code Standards for about three days following each overflow. Wintertime swimming, wading and other intimate water contact activities are virtually non-existent in the impacted areas. Wintertime participation in these activities may increase as a result of the development of the Candlestick Point State Recreation Area but the extent of such increase is unknown. Sport shellfishing is practiced by a 'handfull' of people. Significant increases in recreational shellfishing is not expected in the future as the most accessible locations are already showing signs of depletion. Both City and State epidemiological records indicate that there have been no reported cases of illness resulting from either body contact recreation or consumption of shellfish in the impacted areas. Reduction in the number of overflows, coupled with an improved program of beach & shellfish bed posting will serve to reduce the public health risks from overflows.

- Reduction in the number of overflows per year coupled with some expected reduction in pollutant concentrations of future overflows should reduce adverse impacts to marine organisms. However no estimate in the resulting improvements to either the numbers or the diversity of marine organisms is possible.

- The most serious potential toxicity problem measured in Bayside CSOs was the high levels of chromium found in the influent to the Southeast Plant during portions of one storm. This high chromium level was apparently due to an industrial discharge. High pollutant levels due to industrial discharges may not be acceptable by the EPA as a justification for CSO control as their project approval criteria in PRM 75-34 requires "...that the level of pollution control provided will be necessary to protect a beneficial use even after technology based standards required by Section 301 of PL 92-500 are achieved by industrial point sources....". Steps have been taken toward identifying and controlling the industrial source(s) of the chromium discharges.

- Re-establishment of commercial shellfishing, including mariculture, has been advanced as a primary justification for the control of San Francisco's CSOs. Bacteriological contamination from CSOs are but part of the larger, and probably uncorrectable problem, of bacteriological contamination from urban runoff. Regardless of the number of overflows from San Francisco, commercial shellfishing would either have to be suspended following significant storms, (as practised with the Arcata Bay oyster beds) or employ controlled purification techniques such as relaying or depuration.

- Baffling, screening, disinfection, and posting of beach and shellfish beds were examined as measures to mitigate the adverse impacts of overflows. Only baffling and posting appear to provide benefits consistent with costs and the potential for severe, and possibly hazardous operational problems.

- The costs and benefits of relocating overflows from the head-ends of dead-end sloughs were examined. Costs would be excessive in comparison to the benefits at Channel and Islais Creek. Costs may not be out of proportion to the benefits at Yosemite, as the costs for relocation would be much lower and this area is part of the Candlestick Point State Recreation Area. However relocation of the Yosemite structure will require approval of the State Department of Parks and Recreation.

- The costs and benefits for extended outfalls to meet 10:1 initial dilution were examined. As was the case with the dead-end of slough discharges, the costs would be excessive compared to the benefits.

- A comparably priced alternative to the eight overflow per year control level was developed for the purpose of providing one overflow per year control in the shellfishing areas. Capital costs would be approximately $5,000,000 greater than the eight overflow per year control level and there would be slightly less mass emissions. However the marginal cost per beneficiary (i.e. shellfisher) would be approximately $3,500 per person per day.

Recommendations

- The 8 overflow per year control level best approximates the EPA cost-benefit guidelines and is therefore the recommended control level. The alternative control scheme of 10 overflows north of Hunters Point and 1 overflow per year south of Hunter's Point would be an acceptable alternative, provided that the State and EPA concurs in the fundability of this alternative. Adoptation of either alternative would not physically 'close the door' to providing higher levels of control (less overflows) in the future. Sufficient capacity will be provided within key elements such as the Islais Creek Pump Station and the Crosstown Tunnel to accommodate a high level of control, in the event that a higher level of control becomes necessary in the future. Additional transport/storage elements suggested on Figure VIII-1 would also be required in order to provide a higher degree of control.

- An improved program to post recreational areas and shellfish beds following overflows is warranted and should be implemented. The City's Department of Public Health implement shellfish bed posting following overflows.

- Baffling of the overflows appears cost effective and should be implemented wherever feasible.

- With the possible exception of Yosemite Canal, the costs to comply with both the 'dead-end sloughs and 10:1 initial dilution requirements are out of proportion to the expected benefits and exceptions to these discharge prohibitions should be granted. The City will begin discussions with the California Department of Parks and Recreation in order to establish the cost effectiveness of relocating the Yosemite St. overflow structure to a less confined shoreline area.

BIBLIOGRAPHY

1. San Francisco Wastewater Treatment Pilot Plant Study, CH2M-Hill, Inc., May 1974

2. Corps of Engineers' model of San Francisco Bay, letter from Hugo Fischer, UCB to Dan Norris, B & C, Sept. 11, 1970

3. Draft Final Report Survey of Sport Shellfishing Potential on the Ocean Side of the San Francisco Peninsula, at Mussel Park (San Mateo County) and the Northwestern Section of San Francisco, James E. Sutton, January 1979

4. Seattle's Approach to Evaluating Costs and Benefits of Combined Sewer Overflow Control per PGM-61, Jack Warburton, B & C, June 29, 1978

5. Marine Waste Disposal, Volume I, Brown & Caldwell, 1971

6. Toxic Materials Analysis of Street Surface Contaminants, USEPA R2-73-283, August 1973

7. Water Pollution Aspects of Street Surface Contaminants, USEPA R2-72-081, November 1972

8. Report to Congress on Control of Combined Sewer Overflow in the United States, USEPA, MCD-50, October 1978

9. Beneficial Uses and Overflow Impacts on San Francisco's Bayside Waterfront, Overflow Study Part II, Environmental Science Associates Inc., March 29, 1979

10. Assessment of Trace Metal and Chlorinated Hydrocarbon Contamination in Selected San Francisco Bay Estuary Shellfish, Lawrence Berkeley Laboratory, University of California, Girvin et. al. November 1975

11. Combined Wastewater Control System, Sacramento, Project Report and Draft Environmental Impact Report, Sacramento Area Consultants, August 1975

12. Report to Association of Bay Area Governments San Francisco Bay Region on Surface Runoff Modeling, Metcalf & Eddy, April 1978

13. Combined Sewer Overflow Control Program, Municipality of Metropolitan Seattle, Brown and Caldwell, January 1979

Bibliography (Continued)

14. Shellfish Study of San Francisco Bay April-June 1972, USEPA, June 1974

15. Characterization and Treatment of Combined Sewer Overflows, San Francisco, Engineering-Science, Inc., November 1967

16. Water Quality Control Plan Report, San Francisco Bay Basin, State Water Resources Control Board, April 1975

17. Survey of Sport Shellfishing Potential in San Francisco Bay, in Southern San Francisco and Northern San Mateo Counties, Final Report, James Sutton, December 1978

18. Draft Environmental Management Plan for the San Francisco Bay Region (ABAG 208), Association of Bay Area Governments, March 1978

19. Draft Facility Plan for Upgrading Metro Puget Sound Plants, System-wide Volume Part 1, Basis of Planning, Metropolitan Engineers, 1978

20. SWWPCP Facilities Plan Studies Task 8 Wet Weather Characterization, Metcalf & Eddy, December 1, 1978

21. Public Access Supplement, Staff Report Public Access Planning Project, San Francisco Bay Conservation and Development Commission, March 1979

22. Spatial and Seasonal Variations of Silver, Cadmium, Copper, Nickel, Lead, and Zinc in South San Francisco Bay Water During Two Consecutive Drought Years, U. C. Berkeley, Girvin et.al., June 1978

23. Toxicants, Risebrough et.al., June 1978

24. An Assessment of the Potential for Commercial & Recreational Harvesting San Francisco Bay Shellfish, Jones & Stokes Assoc. Inc., October 1977

25. Southwest Water Pollution Control Plant Project, Draft Project Report, Metcalf & Eddy, April 1979

26. San Francisco Master Plan for Wastewater Management, San Francisco Dept. of Public Works, September 15, 1971

27. Evaluation San Francisco Wastewater Master Plan, J. B. Gilbert, Metcalf & Eddy, March 1973

Bibliography (Continued)

28. Geographical Exploration Sheets I-280, CalTrans, 1969

29. Personal Communication with Walt Dahlstrom, Dept. of Fish & Game, 1979

30. Cabelli, Journal of the Water Pollution Control Federaion, Literature Review, June 1978

31. Abstract Report Northshore, CCSF, November 1978

32. Abstract Report Westside, CCSF, December 1978

33. RWQCB Order #76-24

34. RWQCB Order #78-102, November 21, 1978

35. Photograph San Francisco Bay, NASA Skylab 4, January 26, 1974

36. Effects of Combined Sewer Overflows on Receiving Water Quality, Final Report, J. B. Gilbert & Associates, August 1978

APPENDICES

CITY AND COUNTY OF SAN FRANCISCO

DEPARTMENT OF PUBLIC HEALTH

CENTRAL OFFICE
101 GROVE STREET
SAN FRANCISCO, CALIFORNIA 94102

ENTERIC DISEASE INCIDENCE - SAN FRANCISCO - 1964-1978
Prepared in San Francisco Department of Public Health
16 November 1978

In 25 years of records in the Bureau Of Disease Control, there are no documented laboratory- or clinically-confirmed cases of shigellosis, salmonellosis, or hepatitis A produced by direct contact with shoreline waters or by ingestion of raw bivalves in San Francisco. These three diseases, all reportable by law, are of particular interest in examining the potential role of recreational waters with high coliform count, or marine life from such waters, as possible source of diarrheal diseases (enteric infection) in San Francisco. These diseases are contracted by swallowing the infecting organism. Disease incidence records for diarrheal disease reported in the City from 1964 to the present are attached. Prior to 1967, much of the diarrhea was caused by shigella sonnei, a swallowed bacterium; it produced laboratory- or physician-confirmed reports of diarrhea primarily among the residents of the Spanish ethnic community in the City, more commonly among children than adults, with an annual incidence peak in July-September. Where the source could be determined, most of the cases were traced to food-borne transmission, occasionally in a local restaurant, but more commonly by members of the family household who were found to be fecal carriers who prepared meals for the family. During this period, salmonellosis, the other common bacterial cause of diarrheal disease, was reported at a low constant rate of 100-150 cases per year.

In 1967-68, during the Haight-Ashbury period, the incidence of reported cases of shigellosis did not change significantly, possibly due to insufficient medical care or tansiency of the population in that area, but it did begin a slow rise thereafter, caused by a different strain of shigella. Hepatitis A, caused by swallowing of the hepatitis virus, increased very remarkably during these two years, and remained then at a high level. The rise was attributed to the multiple personal contacts of the crowded, unsanitary, commune-style living conditions in that area and among that population. (The incidence of salmonellosis, in contrast, did not increase. This difference, we believe, is due to a dose/response factor: 10-100 shigellae can produce diarrhea in a human, but it requires 10,000-1,000,000 salmonellae for the same effect.) At the low temperature and high salinity of shore waters, although the organisms could survive, they could not multiply. Laboratory conditions for successful culture require an appropriate nutrient broth or gel medium, and constant temperature of 35°C.(95°F.) for at least 48 hours.

After 1974, a secondary rise in incidence of shigellosis and hepatitis A was found in the expanding alternate life-style communities within the City. Variously, in 75% to 92% of such patients on whom valid histories could be obtained, transmission was found to be by direct intimate personal or household food contact. There is no significant seasonal variation in the incidence of shigellosis, salmonellosis, or hepatitis A as reported in the City since the Haight-Ashbury summers.

Since the first appearance in the literature of reports of ingestion of raw shellfish as a source of possible infection with hepatitis A virus, Department staff have made inquiry on this point from appropriate patients, without confirming cases of such transmission. Although other bivalves could also theoretically concentrate and transmit the hepatitis virus, the local mussels, shrimp, clams, and crab are usually cooked before eating, and the virus would be expected to be destroyed or inactivated in the process. In 25 years of records in the Bureau of Disease Control, there are no documented laboratory- or clinically - confirmed cases of shigellosis/salmonellosis or hepatitis A produced by direct contact with shoreline waters or by ingestion of raw bivalves in San Francisco.

Approved:

Mervyn F. Silverman, M.D., M.P.H.
Director of Public Health

Prepared by:

Selma K. Dritz, M.D., M.P.H.
Assistant Director
Bureau of Disease Control
and Adult Health

REPORTED CASES - SELECTED CAUSES

SAN FRANCISCO DEPARTMENT OF PUBLIC HEALTH

YEAR	SHIGELLOSIS	SALMONELLOSIS	HEPATITIS A
1964	76	104	150
1965	81	99	181
1966	71	118	204
*1967	69	119	552
*1968	48	121	819
1969	144	140	651
1970	85	142	723
1971	159	171	767
1972	254	139	542
1973	208	122	696
1974	189	110	480
**1975	346	107	647
**1976	602	161	912
**1977	325	143	690
**1978 (9 months)	320	110	472

* Haight-Ashbury Period
** Expanded Alternate Life-Styles Period

TABULATIONS AND GRAPHS FOR SELECTED DISEASES REPORTED IN SAN FRANCISCO

DESCRIPTION OF SOURCE MATERIALS

From the files of the San Francisco Department of Public Health, Bureau of Disease Control, we present the following month-by-month incidence of laboratory-confirmed cases of shigellosis and salmonellosis, respectively, as reported in San Francisco for five selected years, in a resident population of roughly 700,000. Records are gathered chiefly from laboratory reports and physicians' Confidential Morbidity Reports, both legally required by order of the California State Board of Health, (see Attachment A) and from other sources, such as Departmental inspectors of food establishments, school nurses and teachers, field public health staff, and local citizens. From 3 to 5% of the patients are residents of other counties or states, diagnosed and reported from medical centers in the City, and therefor recorded as San Francisco cases. Though not all physicians file reports as required, the resulting discrepancy is a constant one throughout the year, and does not affect the configuration of the incidence curves. Disease incidence reports are compared for wet, dry and normal years, both prior to, (1964 and 1967) and following (1973, 74 and 77) the intensive drive by the Department to obtain more complete reporting of disease incidence from physicians. Tabulations which we submitted in a prior release were supplied from the Bureau of Statistics of the Department of Public Health, and are based on the date of receipt of the report. In those tables, some cases which developed late in the year were diagnosed and reported in the following year. But the graphs which are shown here are taken from abstracts of patient histories recorded in the files of the Bureau of Disease Control, and are based on actual date of onset of symptoms. These, therefor, have slightly different annual totals for the selected years than the previous tables. We chose to show incidence of shigellosis, because it is caused by the most frequently identified enteric bacterial pathogen in San Francisco, and one which readily causes disease symptoms with swallowing of a minimal dose (10 to 100 organisms). We show incidence of salmonellosis because it is caused by the hardiest enteric bacterial pathogen, although it requires a much larger dose (10^4 to 10^6 organisms). We do not show incidence of hepatitis A in these exhibits, because we have not, as yet, a readily available laboratory method for definitive identification of the hepatitis A virus.

Analysis of graphs and tables

Data were compared for wet, normal and dry rainfall years. The years 1964 and 1967 were, respectively, wet and normal rainfall years prior to a massive effort by the SFDPH to improve reporting of communicable diseases, as required by State law, by physicians in the community. The years 1973 and 1974 were, respectively, wet and normal rainfall years after the reporting had improved, and numbers of recorded cases subsequently increased. The increase was compounded by development of a large, persistent outbreak of enteric (diarrheal) disease resulting from increased household and direct personal transmission of the infecting organisms, without relation to water sports or ingestion of shellfish. The year 1977 was the most recent drought year.

None of the monthly variations in incidence reports were significant numbers in a population of 700,000. If any comment were made on the small seasonal variations in incidence reports, it would be to note that most of the small increases were recorded during the summer months, when little or no rain falls on the City.

Cabelli et al, in 1976, reported a perspective study done for EPA, on pollution effects on swimmers at two New York beaches. They found that symptoms of fever, headache, diarrheal disease, developed within 10 days of swimming at Coney Island Beach, "a barely acceptable (polluted) one," in 3-4% of swimmers, while the incidence of such symptoms was significantly lower at Rockaway Beach nearby, "a relatively unpolluted one". At both beaches, they found a higher incidence of these symptoms in swimmers, as compared to non-swimmers. The authors did not state the numbers of persons in the water at either of the beaches on the days of their study.

We must point out that the symptoms which they described, and ascribed to the ingestion of various enteric bateria, which they found at elevated levels on those days at those sites (particularly total coliforms), are also the symptoms that are produced by infection with enteroviruses; these enteroviruses are frequently cultured from human urine samples in cases of illness marked by the same symptoms as those described in their paper. If the total population in the water were as high as perhaps 100,000, which is not uncommonly reported from Coney Island Beach on a hot day in summer, the concentration of human urine from direct urination in the water, and potential for high viral concentration in the beach shallows, could be, and probably was, considerable. It is my opinion that the probability of developing enteric disease from ingestion of urinary enteroviruses at those beaches in summer is very much greater than that of infection by fecal organisms.

Such a situation is not comparable to beach conditions in San Francisco. If 1000 or even 2000 persons could be found in the water on a particularly hot day, the concentration of urine in the turbulent shore waters would be almost nil. A similar situation might be postulated for Aquatic Park swimming area by the very small number of persons who actually swim in those waters.

State Department of Public Health, (S. B. Werner, MD), report that no cases are known in their files that confirm enteric disease acquired in recreational waters or by ingestion of shellfish from the Bay Area waters, except for PSP (paralytic shellfish poisoning) from mussels taken during forbidden periods of May through October in this area.

State Fish and Game (Walter Dahlstrom) report that shellfish checked for concentration of heavy metals and a variety of pesticides indicate no public health problem from these substances.

Their concern would be aroused only by elevated coliform counts during periods of high runoff in winter storms.

LAWRENCE LAB BAY AREA SHELLFISH AND SEDIMENT STUDY - PLUS JONES AND STOKES EPA 1977

RECOMMENDATIONS AND FDA PROPOSED STANDARDS

Element	Average Daily uptake	Normal body levels	Lawrence lab findings	Jones & Stokes
Ag	na	na	Elevated So. Bay shellfish	no standards
As	na	na	na	no standards
Cd	15-35 ug	1 ug/gm wet tissue	3ppm Tara Hills. Coypte Pt. No., Foster City	0.5 ppm ss clam 1.5 oysters. So. 3.5 oysters. No.
Co.	0.1 ug (B12?)	80-300uug. blood	na	na
Cr.	na	6 mgm total body	na	5 ppm ss clam 2 ppm oysters
Cu	2.5-5 mgm	100 ug/100 ml blood	na	25 ppm ss clam 42 oysters So. 175 oysters No.
Fe	18 mg.	70-18- ug/100 ml serum	na	na
Hg	na	na	safe levels found	0.5 ppm*
I	100 ug	20-35 ug/100ml plasma	na	na
Mg	na	na	na	na
Mn	3-9 mgm, 40% absorbed	2.5 ug/100 ml plasma	na	na
Mo	na	0.1-3 ppm, total body	na	na
Ni	na	na	na	na
Pb	?.20 mgm???-5-10% absorbed?	child: 30ug/100ml bld adult: 60ug/100ml bld	safe levels except Albany Hills & Bayview Park	5 ss clam 2 oysters
Se	? Vit E?? Cystic fibrosis?	0.22 ug/100ml Blood	na	na
Zn	10-15 mgm, 30% absorbed	900 ug/100ml blood	na/	30 ss clam 1000 oysters So., 2000 oysters No.

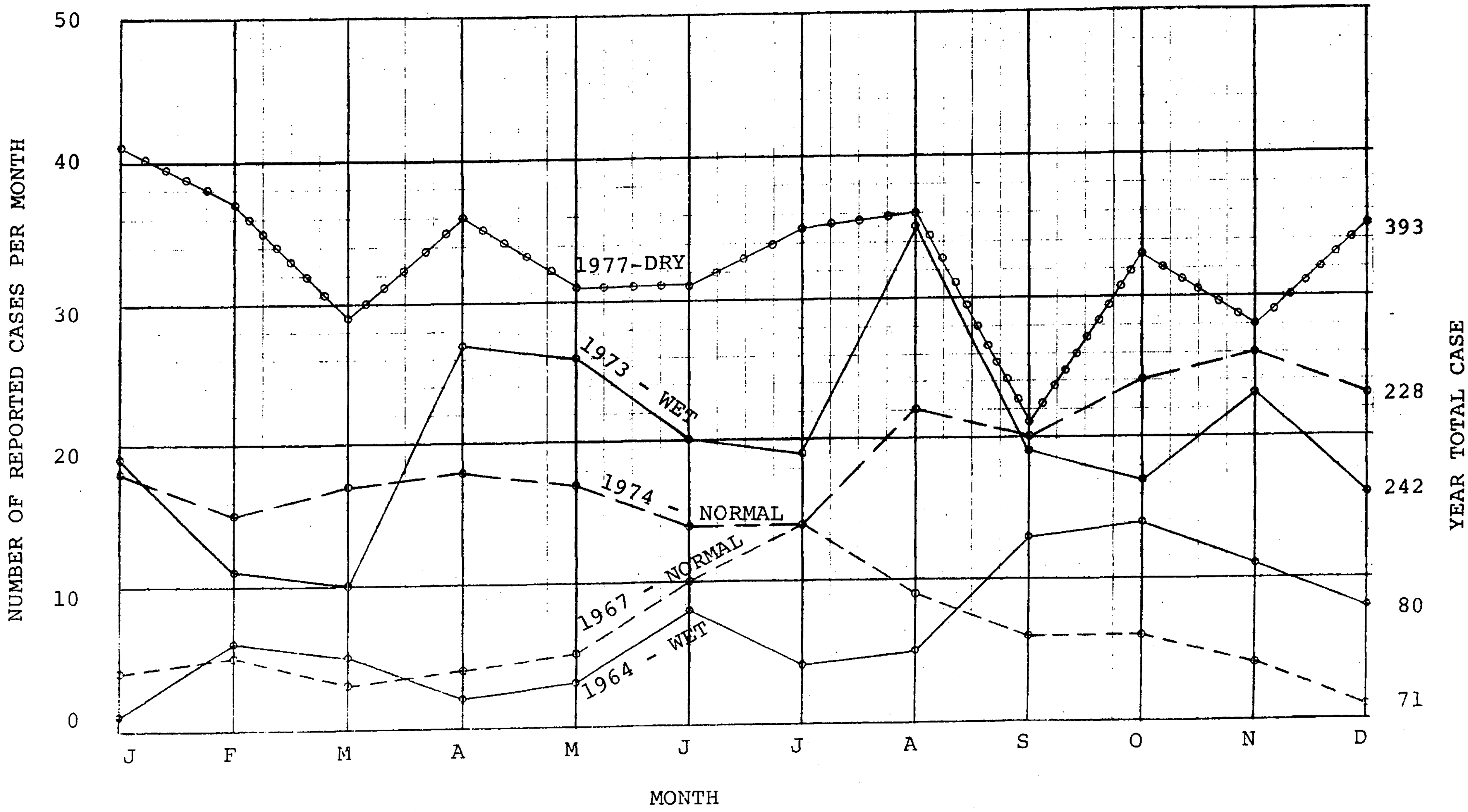
DDT)
Chlorinated hydrocarbons) all levels safe and acceptable
Organophosphates ??)

* New FDA standard is 1.0 ppm

SHIGELLOSIS CASES REPORTED - SAN FRANCISCO

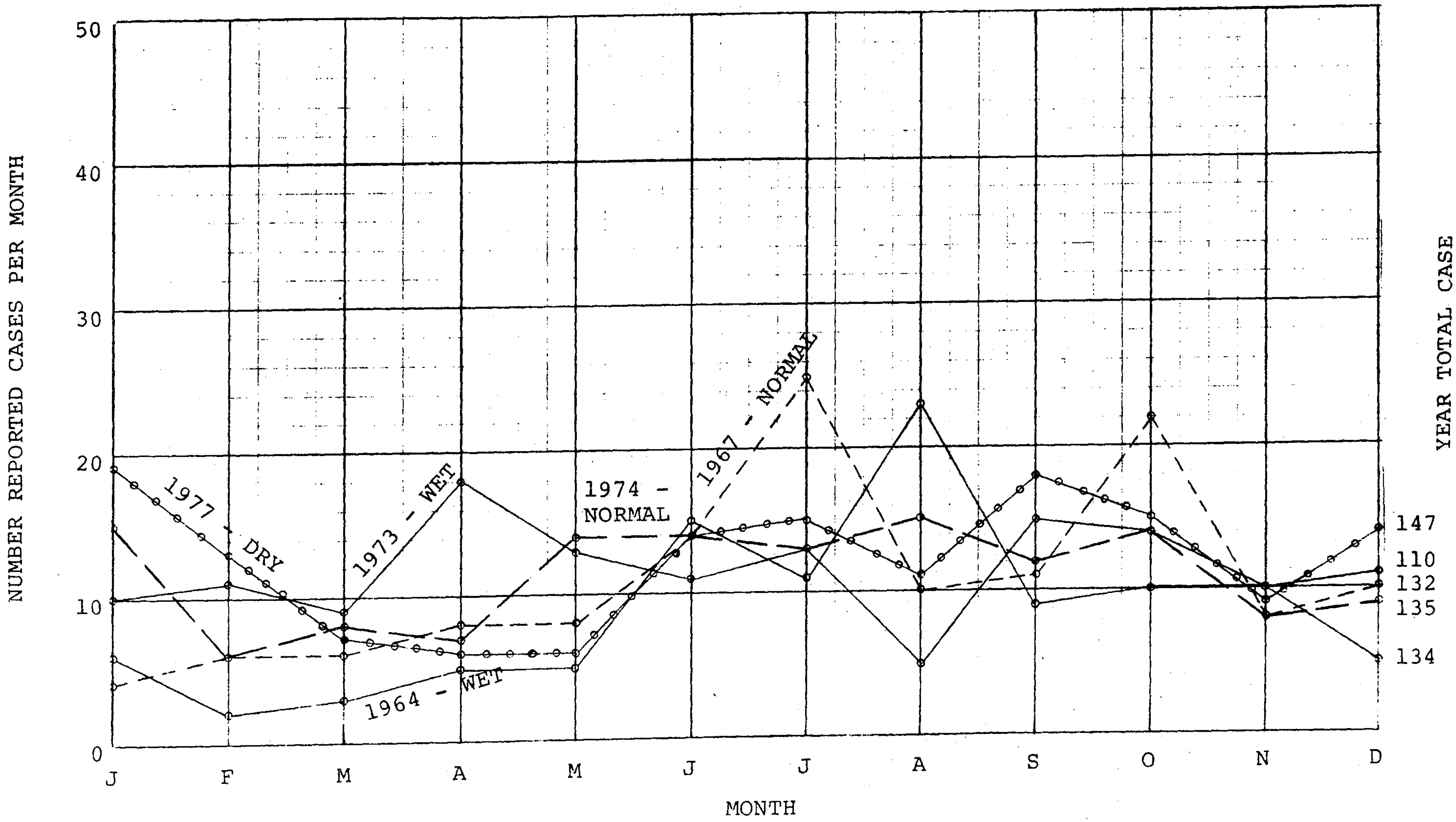
SELECTED YEARS

POPULATION: 700,000



SALMONELLOSIS CASES REPORTED - SAN FRANCISCO
SELECTED YEARS

POPULATION: 700,000



REGULATIONS OF THE CALIFORNIA STATE BOARD OF PUBLIC HEALTH FOR THE CONTROL OF COMMUNICABLE DISEASES†

GENERAL SECTIONS

2500. Reporting to the Local Health Authority. It shall be the duty of every physician, practitioner, dentist, coroner, every superintendent or manager of a dispensary, hospital, clinic, or any other person knowing of or in attendance on a case or suspected case of any of the following diseases or conditions, to notify the local health authority immediately. A standard type report form has been adopted and is available for this purpose.

- *Amebiasis
- Anthrax
- Botulism
- Brucellosis (Undulant Fever)
- *Chancroid
- Cholera
- *Coccidioidomycosis
- *Conjunctivitis, Acute Infectious of the Newborn (Gonorrheal Ophthalmia, Ophthalmia Neonatorum, and Babies' Sore Eyes in the first 21 days of life)
- Dengue
- Diarrhea of the Newborn
- Diphtheria
- Disorders Characterized by Lapses of Consciousness
- Dysentery, Bacillary (see Shigella infections)
- Encephalitis, viral
- Food Poisoning (other than Botulism)
- *German Measles (Rubella)
- *Gonococcal Infections
- *Granuloma Inguinale
- Hepatitis, Infectious
- Hepatitis, Serum
- Leprosy (Hansen's Disease)
- Leptospirosis (including Weil's Disease)
- *Lymphogranuloma Venereum (Lymphogranuloma Inguinale)
- Malaria
- *Measles (Rubeola)
- Meningitis, Viral
- Meningococcal Infections
- *Mumps
- Paratyphoid Fever, A, B and C (see Salmonella infections)
- *Pertussis (Whooping cough)
- Plague
- Poliomyelitis, Paralytic
- Psittacosis
- Q Fever
- Rabies, Human or Animal
- Relapsing Fever
- *Rheumatic Fever, Acute
- Rocky Mountain Spotted Fever
- *Salmonella Infectious (exclusive of typhoid fever)
- *Scarlet fever
- *Shigella Infections
- Smallpox (Variola)
- *Streptococcal Infections, hemolytic (including Scarlet Fever, and Streptococcal Sore Throat)
- Syphilis
- Tetanus
- *Trachoma
- Trichinosis
- Tuberculosis
- Tularemia
- Typhoid fever, cases and carriers
- Typhus fever
- Viral Exanthem in Pregnant Women
- Yellow fever

For outbreak reporting and reporting of occurrence of unusual and rare diseases see Sections 2502 and 2503.

~~*2501. Reports by Local Health Officer to State Department of Public Health.* (a) Individual case reports: Each local health officer shall report at least weekly, on the prescribed form, to the Director of the State Department of Public Health each individual case of those diseases or conditions not marked with an asterisk (*) in the above list (Section 2500) which have been reported to him in the last seven days.~~

† From California Administrative Code, Title 17, Public Health.
* See Section 2501.

STATE OF CALIFORNIA—HEALTH AND WELFARE AGENCY EDMUND G. BROWN JR., Governor

DEPARTMENT OF HEALTH SERVICES
2151 BERKELEY WAY
BERKELEY, CA 94704
(415) 843-7900, Ext. 246

December 6, 1978

Selma Dritz, M.D.
Communicable Disease Control Officer
San Francisco City & County Health Department
101 Grove Street
San Francisco, California 94102

Dear Doctor Dritz:

NO REPORTS OF ENTERIC DISEASE IN SWIMMERS OFF THE SAN FRANCISCO COAST

In response to your request today for a written statement on this issue, let me say that the State's Infectious Disease Section has received no reports in recent years linking any enteric disease in individuals or groups of individuals to recreational use (swimming, surfing, boating, etc.) of waters in the immediate San Francisco area. This should not be construed to mean that there hasn't been any such disease .... only that none has been reported to us.

Potential disease does exist, however, not only from a theoretic point of view but as can be seen by published reports. But reports of disease from polluted recreational water are really quite rare. The major threat from such water comes from purposeful ingestion of the water or the consumption of raw or inadequately heated shellfish harvested from it. Nonetheless, reasonable efforts should be made to minimize the risk that San Francisco Bay waters may pose to the public's health.

Sincerely yours,

Ben

S. B. Werner, M.D.
Medical Epidemiologist
Infectious Disease Section

APPENDIX B

SUPPLEMENTARY OVERFLOW MONITORING PROGRAM

This program was initiated in response to the EPA letter of December 20, 1978 requesting data on the toxic constituents of overflows. The EPA specifically requested data on the levels of lead, mercury, cadmium, TICH, and stickleback survivals in undiluted waste for two storms at the following six overflow structures:

District	Structure
Westside	Lincoln Way
	Bakers Beach
Northshore	Laguna Street
	Beach Street
Southeast	Yosemite Street
	Sunnydale Avenue

The City elected to add a third storm; add sampling for total, coliform, fecal coliform, pH, temperature, salinity and add additional receiving water sampling stations. The primary purpose of these additions was to gain some insight into the dispersion of the overflow fields.

The City contracted this work to the engineering firm of Brown & Caldwell (B & C) in Walnut Creek. All samples were collected by B & C personnel and laboratory analysis was done by their Environmental Services Division's laboratory in Emeryville except trace organics which were analysed by Stoner Laboratories in Santa Clara. Discharge and shoreline samples were collected by ground crews; a helicopter chartered from Spirit Airways was used to collect the offshore samples. All receiving water samples were surface samples.

Whenever rainfall appeared imminent the field crews and helicopter were put on 'standby'. The crews and helicopter proceeded to the sampling stations immediately upon notification by the City that an overflow had commenced. The single grab sample of each station was typically collected two to three hours after start of overflow. All laboratory analysis was done in accordance with Standard Methods.

Results

The results are tabulated in the attachment. Station 1 at all sites designates the sample collected in the overflow structure or in the sewer system at the first convenient manhole upstream of the structure. Station 2 samples at all sites were collected as close as practical to the discharge-receiving water interface. The remaining stations are offshore or longshore stations added for the purpose of determining overflow dispersion. An exception is at Sunnydale where Station 3 represents the discharge from the northerly of two - 39" ± State highway culverts stradling the City's overflow structure.

Discussion of Results

The applicable standards for toxic substances in waste discharges are as follows:

Westside (Ocean Plan)

Table B*

Parameter	Unit	6-Month Median	Daily Maximum	Instantaneous Maximum
Lead	ug/l	8	32	80
Cadmium	ug/l	3	12	30
Mercury	ug/l	0.14	0.56	1.4
Total chlorinated pesticides and PCB's	ug/l	2	4	6

*Metals are receiving water - TICH and PCB's limits apply to the discharge.

Table A

Parameter	Unit	30 Day Mean	7 Day Mean	Maximum
Toxicity Concentration	tu	1.5	2.0	2.5
pH		6.0 to 9.0 at all times		

Bay Discharges* (Effluent Limits)

Parameter	Unit	50%-ile	90%-ile
Lead	ug/l	100	200
Mercury	ug/l	1.0	2.0
Cadmium	ug/l	20	30
TICH	ug/l	2.0	4.0
Toxicity	tu	1.5	2.0
pH	pH units	6.0 to 9.0 at all times	

*The RWQCB normally uses the 1972 Ocean Plan effluent limits contained in this table for Bay discharges.

Comparison of Results with Standards

Cadmium

With the exception of Yosemite and Sunnydale all cadmium values were below the limits of detectability of 1 ug/l. The highest cadmium value recorded was 4 ug/l (at Yosemite) which is 20% of the median standard for Bay discharges.

Mercury

The highest westside mercury level recorded in the discharge was 1.7 ug/l which is slightly higher than the instantaneous receiving water maximum of 1.4 ug/l. However the highest receiving water value (1.1 ug/l) is within standards.

All Bayside Station 1 and Station 2 mercury levels were equal to or less than the 50%-ile level of 1 ug/liter. One remote sample (Station 5 at Sunnydale-third storm) had a surprisingly high level of 9 ug/l. Whether this level was a result of overflow, discharge from the highway culverts, other storm drains in this area, dumping or sample contamination is unknown.

Lead

The highest lead values found were 234 ug/l (Sunnydale overflow) and 330 ug/l (Sunnydale highway culvert). These values are comparable to previously reported values of the City's CSO and are comparable to average values reported for separate storm systems in urban areas (e.g. 334 ug/l - Sacramento, 300 ug/l-Seattle) and are in excess of effluent limits. However, only one of the six Station 2 receiving water samples for the Westside exceeded the receiving water maximum of 80 ug/l. All six Northshore discharge levels were below the 200 ug/l - 90%-ile level and all Northshore receiving water lead levels were below 80 ug/l. The Station 2 levels at Sunnydale and Yosemite generally exceeded 80 ug/l but only one of the remote station samples was in excess the 80 ug/l level.

Chlorinated Hydrocarbons and PCB's

Analysis for the following chlorinated hydrocarbons and polychlorinated biphenyls (PCB's) was done on all effluent samples, and Station 2 samples.

Chlorinated Hydrocarbons	Normal Detection Limits (ug/l)*
Aldrin	0.05
BHC isomers (incl. Lindane)	0.05
Technical Chlordane	0.10
DDD (TDE)	0.10
DDE	0.05
DDT	0.10
Dieldrin	0.05
Endrin	0.05
Heptachlor	0.05
Heptachlor epoxide	0.05
Hexachlorobenzene	0.05
Methoxychlor	0.10
Toxaphene	1.0
PCB's	
1254	0.1
1260	0.1

*Detection limits for some hydrocarbons in a few samples were higher due to high turbidity.

Technical chlordane was found in 15 of the 39 samples tested and was the only chlorinated hydrocarbon found. The maximum level detected was 0.2 ug/1. PCB's were detected in 17 of the 39 samples - maximum levels were 0.4 ug/1 for PCB 1254 and 1.1 ug/1 for PCB 1260. TICH plus PCB levels were below the most stringent standard of 2.0 ug/1 in all cases (Total values computed per footnote 13 of the Ocean Plan).

pH

All but two of the effluent pH values were within the permitted 6.0 to 9.0 range. One pH of 5.5 was obtained at Sunnydale and one pH value of 5.9 was noted at Yosemite. The corresponding Station 2 receiving water pH levels were 7.2 and 7.8 respectively.

Temperature

Discharge temperature is a problem only the case of elevated temperatures. In no case did the temperature of the discharge exceed the receiving water temperature by more than 1°C.

Toxicity

Toxicity tests were run on all discharges and all Station 2 samples. Since survival in undiluted waste was the only toxicity value requested in the EPA letter the toxicity testing was changed from the normal geometrically scaled concentrations to a test using two replicates of ten sticklebacks each in the undiluted waste with a control batch of ten sticklebacks per test. No salinity adjustments were made. Survival in the control was 100% in all tests.

Aggregate survival rates for the Westside overflows was 98.3% (two deaths) in the discharge and 97.5% for the receiving water samples (3 deaths). Two of the three receiving water deaths occurred from a sample taken with a salinity of 29 ppt (Lincoln Way - Storm #2) and may in part be attributable to salinity stress as laboratory sticklebacks are acclimatized to a salinity of 15 ppt and will often display stress when exposed to normal oceanic salinites (Steve Fischer B & C lab director-pers. comm.).

100% survial occurred in five of the six Northshore overflow samples. 70% mortality occurred in a sample taken at Laguna Street during the first storm. This sample was obtained from the sewer shortly after the cessation of the overflow. Overflows at Laguna contain a very high percentage of sanitary flow as this overflow serves a small but heavily populated area (Note relatively high fecal coliform values - very low lead values at Laguna). The heavy mortality was possibly due to high ammonia levels associated with the sanitary fraction. All Northshore receiving water samples had 100% survival.

100% survival occured in all six Southeast discharge samples and the two discharge samples taken at the highway culvert. 100% mortality occurred in Station 2 sample taken at Yosemite during the second storm. An examination of the coliform and salinity data for Station 2 indicates that the receiving water was essentially 100% overflow (Salinity was 0.06 ppt - coliform levels were approximately equal to the discharge levels). This heavy mortality could have been caused by a slug of toxic material in the overflow, resuspension of toxic material deposited during an earlier overflow or resuspension of toxic material dumped in Yosemite Channel (this area has been extensively used for dumping). All other receiving water bioassays in the Southeast Zone had 100% survivals.

If one considers all three Station 2 samples at Yosemite as being a second replicate of the effluent then overall discharge toxicity values are as follows:

Toxicity Units*	#/Samples	% of Total
Ocean Discharges		
0.41	5	83
0.59	1	17
Bay Discharges		
0.41	13	86.7
1.1$\pm$	1	6.7
indeterminate	1	6.7

$$*Tu = \frac{\text{Log }(100-S)}{1.7}$$

Toxicity for the Ocean discharges is within Ocean Plan effluent limits. Bay toxicities are within the median criteria but are marginal with respect to the 90%-ile criteria.

Estimates of Initial Dilution & Dispersion

Receiving water coliform, lead and salinity data were analysed to develop the following tentative estimates of initial dilution and dispersion. Outlier values, (mainly low coliform data indicative of outside the field stations) were rejected and lead values were not used at Sunnydale and Yosemite due to known storm drain discharges near these outfalls.

Lincoln Way

An initial dilution of approximately 2:1 was achieved immediately adjacent to the outfall. The shore line stations 500' and 1000' from the outfall indicated a dilution of approximately 20:1 There was no consistent difference between the 500' and 1000' shoreline stations. The field achieved a dilution of approximately 70:1 upon reaching the offshore stations (300' to 600' from the outfall) Cursory inspection of this data indicated no consistent differences between the offshore stations. The dominant direction of the initial field movement appears to be longshore.

Bakers Beach

Apparent initial dilution was 3:1, dilution reached 7:1 at the shoreline stations 500' from the discharge and approximately 22:1 at the 1000' and 1500' shoreline stations northeasterly of the outfall. Dilution was approximately 10:1 at the offshore stations (300' to 600' from the point the stream enters the surf). The stronger offshore movement here is possibly due to the generally calmer surf and steeper littoral slopes.

Laguna Street

The data suggest an initial dilution of 3½:1; a dilution of 6:1 at 600' from the outfall and a dilution of 20:1 just beyond the pier line (1200' from the outfall).

Beach Street

Initial dilution was approximately 2½:1.

Yosemite

Essentially no initial dilution occurs at this location due to the highly confined conditions. The coliform data for the offshore Station (Station 3 - 4500' from the outfall) suggests that this station was outside of the field when sampled during the first two storms and possibly outside of the field during the third storm. Therefore, an estimate of dilution at Station 3 is not justified.

Sunnydale

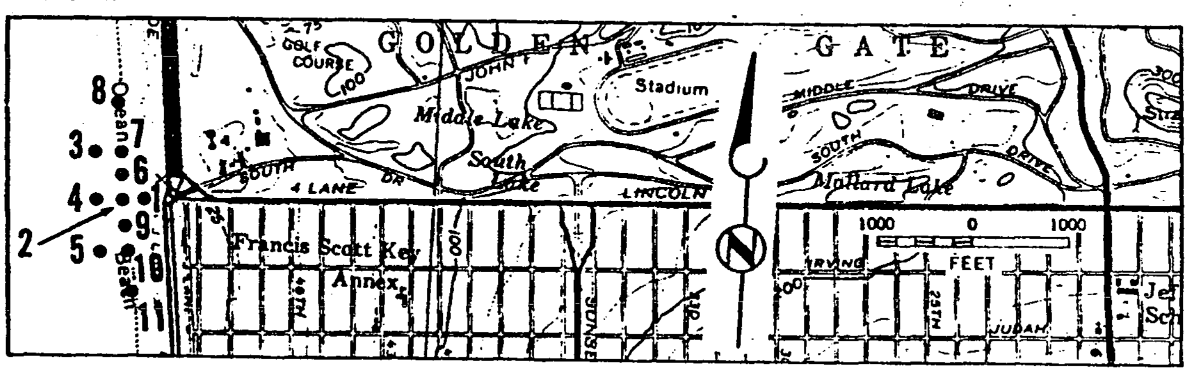
Initial dilution is approximately 1:1 with a dilution of approximately 25:1 being achieved at the three distant stations (Stations 4, 6 and 7 - 1000' to 1200' from the outfall).

LINCOLN WAY OUTFALL

SUPPLEMENTARY OVERFLOW MONITORING PROGRAM

Survey	Station	Total Coliforms MPN/100 ml	Fecal Coliforms MPN/100 ml	Pb µg/l	Hg µg/l	Cd µg/l	TICH µg/l	PCB µg/l	96-hr Bioassay % survival	Temp. °C	pH	Salinity ppt
30Jan79	1	3.3×10^6	2.1×10^5	42	<0.1	<1	ND	ND	90	7.0	7.5	<1
	2	1.3×10^6	2.8×10^5	32	1.0	<1	ND	ND	100	8.0	7.7	12
	3	1.6×10^5	1.7×10^4	5	<0.1	<1	-	-	-	11.0	7.9	30
	4	2.4×10^4	7.9×10^3	<1	<0.1	<1	-	-	-	11.0	7.9	30
	5	7.0×10^3	2.1×10^3	<1	<0.1	<1	-	-	-	11.0	7.9	30
	6	-	-	-	-	-	-	-	-	-	-	
	7	4.9×10^4	7.9×10^3	-	-	-	-	-	-	10.0	7.8	12
	8	1.3×10^5	6.3×10^3	-	-	-	-	-	-	10.0	7.9	30
	9	-	-	-	-	-	-	-	-	-	-	-
	10	7.9×10^4	1.7×10^3	-	-	-	-	-	-	10.0	7.9	31
	11	3.3×10^4	1.7×10^3	-	-	-	-	-	-	10.0	7.9	30
13Feb79	1	2.7×10^6	9.4×10^5	103	1.7	<1	0.1[a]	ND	100	13.0	6.4	0.55
	2	2.4×10^5	7.9×10^3	4	1.1	<1	ND	ND	90	12.0	8.2	29.4
	3	7.0×10^1	3.3×10^1	<1	0.3	<1	-	-	-	12.0	8.3	29.4
	4	2.4×10^3	3.3×10^2	<1	0.7	<1	-	-	-	12.0	8.3	30.1
	5	1.3×10^4	4.9×10^3	<1	0.5	<1	-	-	-	12.0	8.3	28.0
	6	-	-	-	-	-	-	-	-	-	-	-
	7	4.9×10^5	4.9×10^4	-	-	-	-	-	-	12.0	8.2	25.9
	8	3.3×10^5	4.9×10^4	-	-	-	-	-	-	12.0	8.2	26.6
	9	-	-	-	-	-	-	-	-	-	-	-
	10	1.3×10^4	4.9×10^3	-	-	-	-	-	-	12.0	8.2	30.1
	11	2.6×10^4	4.9×10^3	-	-	-	-	-	-	12.0	8.2	28.7
20Feb79	1	3.3×10^6	1.1×10^6	76	1.4	<1	0.1[a]	ND	100	12.0	6.2	0.04
	2	1.3×10^6	4.9×10^5	181	0.1	<1	0.2[a]	0.1[b]	100	12.0	6.9	6.3
	3	4.9×10^3	1.3×10^3	1	<0.1	<1	-	-	-	-	8.2	27.7
	4	1.3×10^4	4.9×10^2	<1	<0.1	<1	-	-	-	-	8.3	27.7
	5	9.2×10^4	1.7×10^3	9	<0.1	<1	-	-	-	-	8.3	26.0
	6	-	-	-	-	-	-	-	-	-	-	26.7
	7	2.2×10^5	1.3×10^4	-	-	-	-	-	-	-	8.0	26.0
	8	2.2×10^5	2.2×10^5	-	-	-	-	-	-	-	8.2	26.3
	9	-	-	-	-	-	-	-	-	-	-	27.0
	10	1.3×10^5	2.2×10^4	-	-	-	-	-	-	-	8.2	26.0
	11	1.1×10^5	7.9×10^3	-	-	-	-	-	-	-	8.3	27.7

[a]Technical chlordane; all others not detected (ND).
[b]PCB 1254.

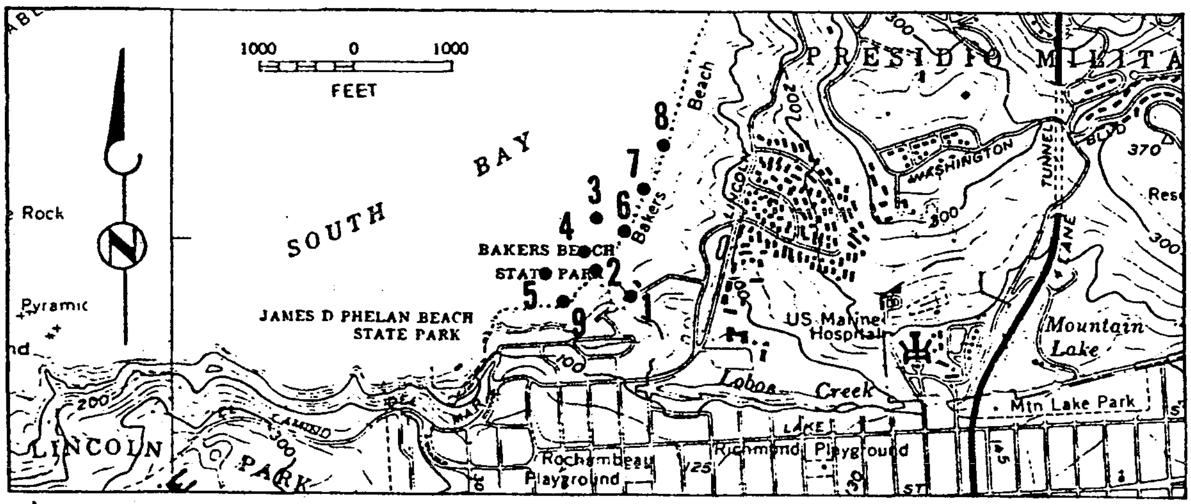


BAKER BEACH OUTFALL

SUPPLEMENTARY OVERFLOW MONITORING PROGRAM

Survey	Station	Total Coliforms MPN/100 ml	Fecal Coliforms MPN/100 ml	Pb µg/l	Hg µg/l	Cd µg/l	TICH µg/l	PCB µg/l	96-hr Bioassay % survival	Temp. °C	pH	Salinity ppt
30Jan79	1	3.3×10^5	4.9×10^4	25	<0.1	<1	ND	ND	100	11.0	7.3	<1
	2	4.9×10^4	1.3×10^4	15	<0.1	<1	ND	ND	100	10.0	7.8	24
	3	1.1×10^4	2.4×10^3	4	0.5	<1	-	-	-	11.0	7.9	28
	4	2.4×10^4	2.4×10^4	8	<0.1	<1	-	-	-	11.0	7.9	28
	5	2.4×10^5	1.3×10^5	10	<0.1	<1	-	-	-	10.5	7.9	26
	6	2.2×10^4	7.0×10^3	-	-	-	-	-	-	10.0	7.9	24
	7	3.3×10^4	4.9×10^3	-	-	-	-	-	-	10.0	7.9	26
	8	3.1×10^4	3.3×10^3	-	-	-	-	-	-	10.0	7.9	28
	9	7.0×10^4	1.1×10^4	-	-	-	-	-	-	10.0	7.9	24
13Feb79	1	1.3×10^6	2.4×10^5	51	0.3	<1	0.2[a]	ND	100	8.0	6.6	0.29
	2	3.3×10^5	2.2×10^4	21	0.5	<1	ND	ND	95	12.0	7.9	19.0
	3	1.3×10^5	2.8×10^4	3	1.1	<1	-	-	-	12.0	8.1	25.9
	4	4.9×10^4	7.9×10^3	<1	0.2	<1	-	-	-	12.0	8.2	26.6
	5	4.9×10^4	1.1×10^4	<1	0.4	<1	-	-	-	12.0	8.2	26.6
	6	3.3×10^4	7.9×10^3	-	-	-	-	-	-	12.0	8.1	26.6
	7	2.4×10^4	1.3×10^4	-	-	-	-	-	-	12.0	8.2	26.6
	8	3.3×10^3	1.3×10^3	-	-	-	-	-	-	12.0	8.3	23.2
	9	1.3×10^5	7.9×10^4	-	-	-	-	-	-	12.0	8.1	23.7
20Feb79	1	1.7×10^6	7.0×10^4	33	0.2	<1	ND	ND	100	-	7.8	0.21
	2	7.9×10^4	4.9×10^4	8	0.2	<1	ND	ND	100	-	8.2	21.8
	3	1.1×10^3	4.0×10^1	3	0.2	<1	-	-	-	12.0	8.1	23.6
	4	3.3×10^2	2.0×10^1	8	0.2	<1	-	-	-	11.8	8.1	23.6
	5	4.9×10^4	4.9×10^4	4	<0.1	<1	-	-	-	12.0	8.1	23.6
	6	7.0×10^4	3.3×10^3	-	-	-	-	-	-	-	8.1	23.3
	7	4.6×10^2	2.3×10^2	-	-	-	-	-	-	-	8.1	23.9
	8	3.3×10^4	1.3×10^4	-	-	-	-	-	-	-	8.0	23.3
	9	2.3×10^4	4.9×10^3	-	-	-	-	-	-	-	7.6	21.2

[a]Technical chlordane; all others not detected (ND).



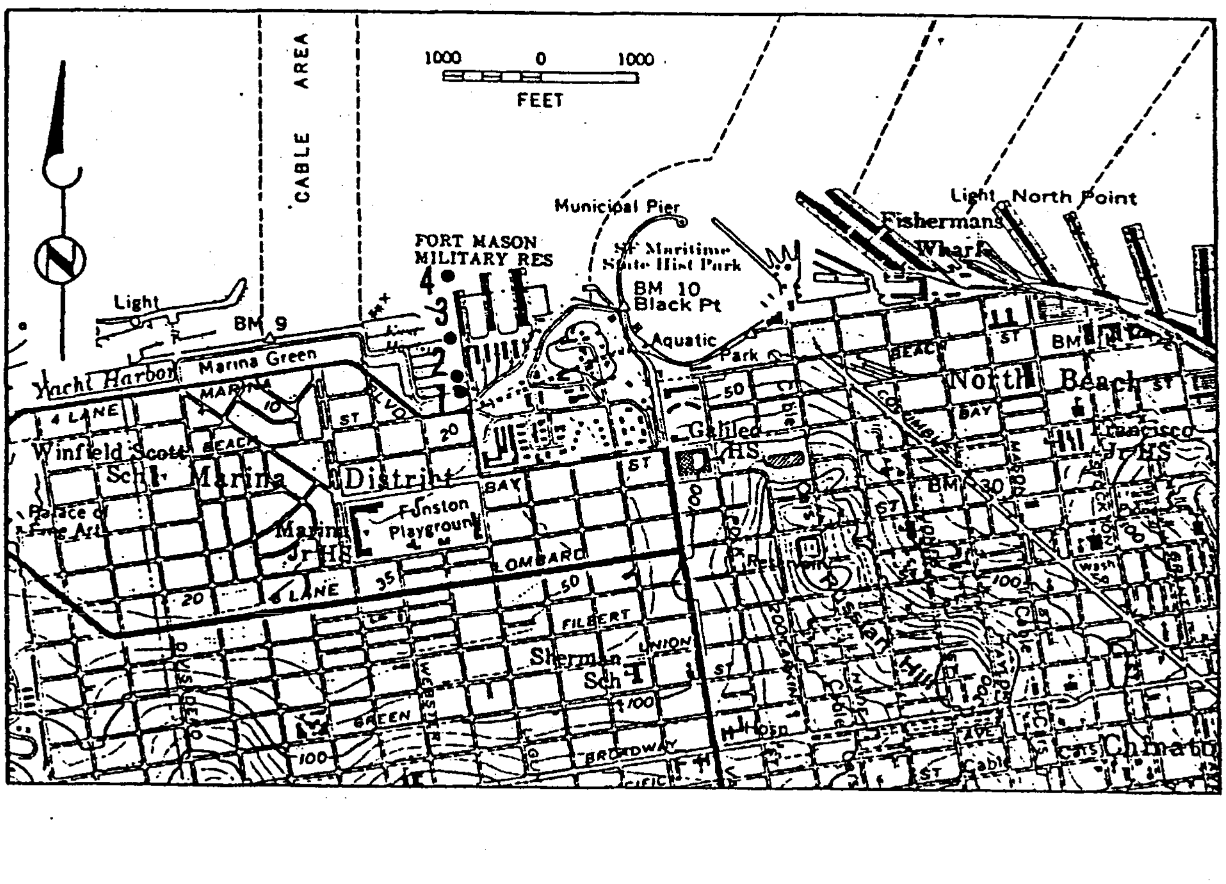
LAGUNA STREET OUTFALL

SUPPLEMENTARY OVERFLOW MONITORING PROGRAM

Survey	Station	Total Coliforms MPN/100 ml	Fecal Coliforms MPN/100 ml	Pb µg/l	Hg µg/l	Cd µg/l	TICH µg/l	PCB µg/l	96-hr Bioassay % survival	Temp. °C	pH	Salinity ppt
30Jan79	1[a]	4.6×10^6	1.3×10^6	40	0.4	<1	ND	ND	30	-	7.4	<1
	2	4.6×10^4	4.6×10^3	8	0.9	<1	ND	ND	100	-	7.9	28
	3	1.3×10^5	4.9×10^4	5	0.4	<1	-	-	-	-	7.6	22
	4	9.2×10^4	7.0×10^3	2	0.3	<1	-	-	-	10.5	7.8	28
13Feb79	1	2.4×10^6	2.4×10^6	63	0.4	<1	ND	ND	100	13.0	6.3	0.03
	2	1.7×10^6	7.9×10^5	39	0.5	<1	ND	ND	100	12.5	7.3	14.3
	3	7.9×10^4	3.3×10^4	17	0.4	<1	-	-	-	11.0	8.0	23.7
	4	2.4×10^5	7.9×10^4	10	0.3	<1	-	-	-	12.0	8.0	24.5
20Feb79	1	4.9×10^6	2.3×10^6	62	0.2	<1	0.1[b]	ND	100	13.0	6.2	0.05
	2	2.2×10^5	7.0×10^4	14	<0.1	<1	ND	ND	100	12.0	7.5	18.4
	3	1.7×10^6	4.9×10^5	17	0.2	<1	-	-	-	11.5	8.0	21.4
	4	7.9×10^1	2.3×10^1	4	<0.1	<1	-	-	-	12.0	8.1	20.1

[a] No overflow; sample taken upstream in sewer.

[b] Technical chlordane; all others not detected (ND).



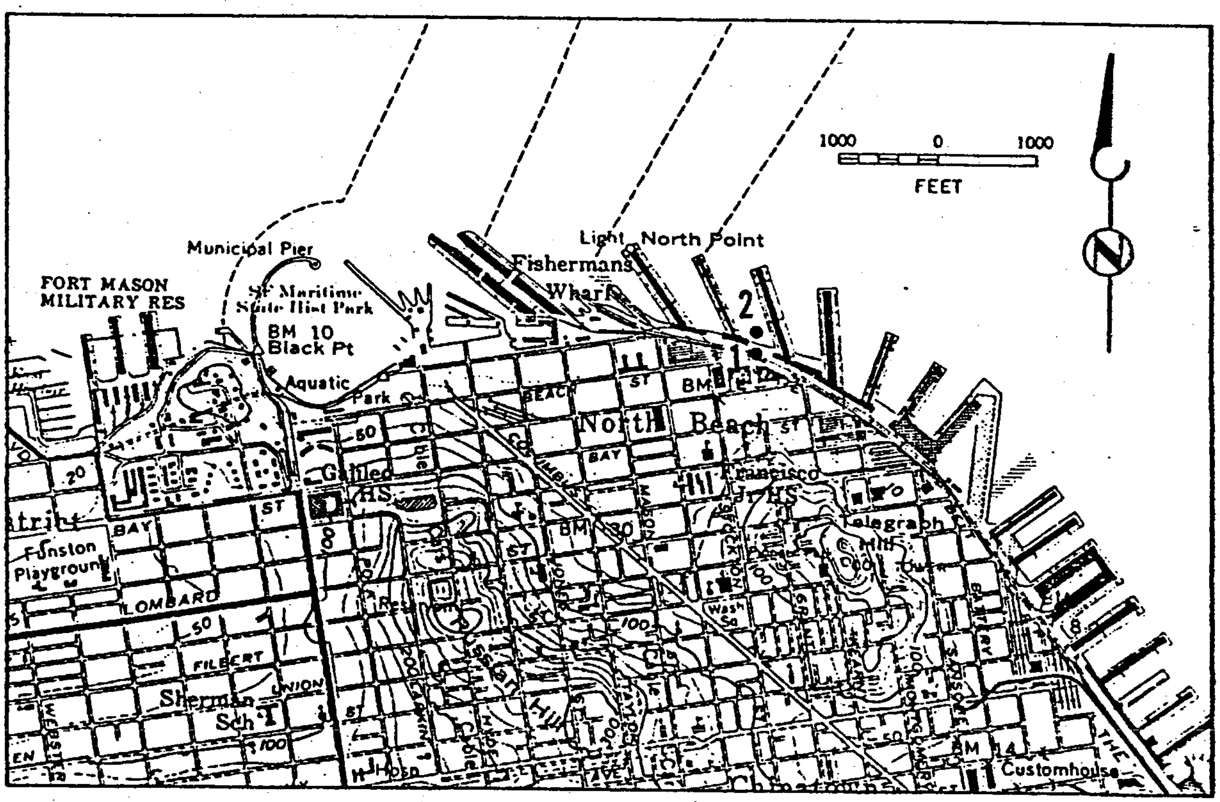
BEACH STREET OUTFALL

SUPPLEMENTARY OVERFLOW MONITORING PROGRAM

Survey	Station	Total Coliforms MPN/100 ml	Fecal Coliforms MPN/100 ml	Pb µg/l	Hg µg/l	Cd µg/l	TICH µg/l	PCB µg/l	96-hr Bioassay % survival	Temp. °C	pH	Salinity ppt
30Jan79	1	2.4×10^5	2.4×10^5	120	0.1	<1	0.1[a]	0.1[b]	100	9	6.8	<1
	2	1.1×10^6	7.9×10^4	18	<0.1	<1	ND	ND	100	10	7.7	25
13Feb79	1	2.4×10^6	2.8×10^5	70	0.3	<1	ND	ND	100	13.0	6.0	0.05
	2	3.5×10^6	1.7×10^5	50	0.6	<1	0.1[a]	0.1[b]	100	13.0	6.8	9.5
20Feb79	1	3.5×10^6	4.9×10^5	105	<0.1	<1	0.1[a]	0.1[b]	100	12.0	5.9	0.06
	2	4.9×10^5	7.0×10^4	17	0.2	<1	ND	ND	100	11.0	7.8	18.4

[a]Technical chlordane; all others not detected (ND).

[b]PCB 1254.



YOSEMITE OUTFALLS

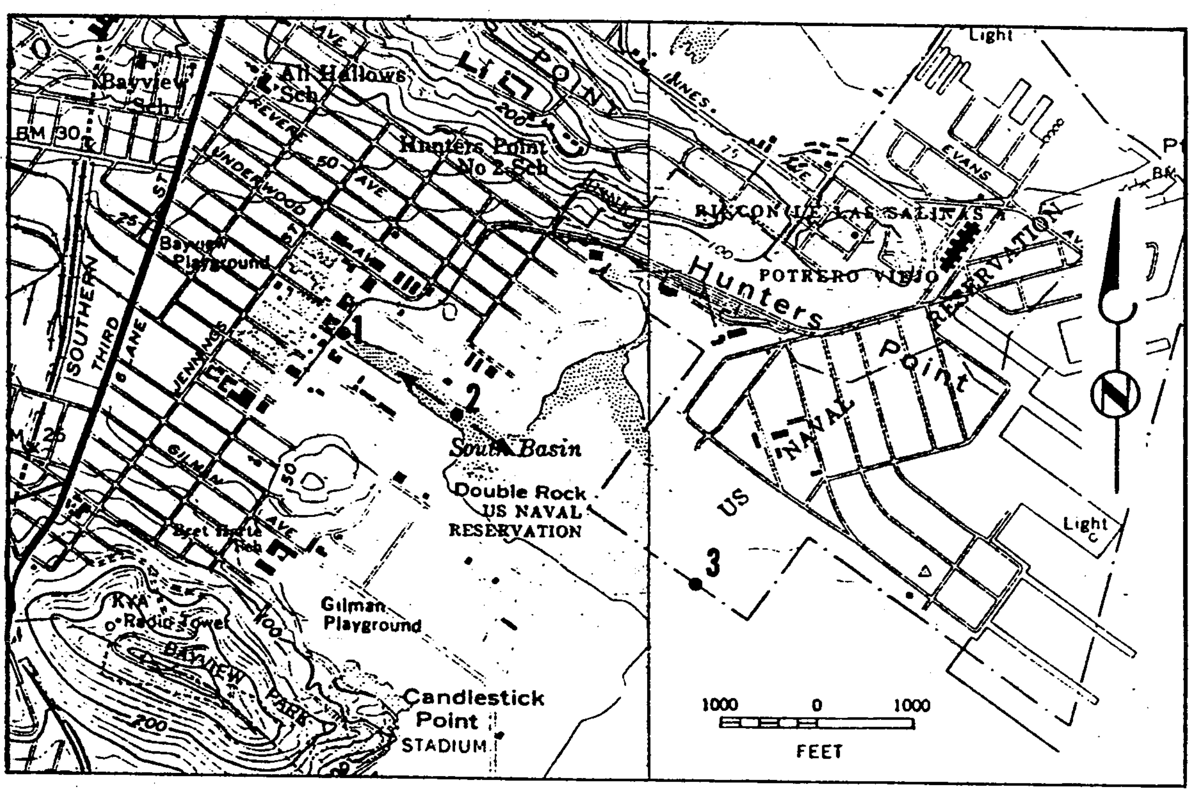
SUPPLEMENTARY OVERFLOW MONITORING PROGRAM

Survey	Station	Total Coliforms MPN/100 ml	Fecal Coliforms MPN/100 ml	Pb µg/l	Hg µg/l	Cd µg/l	TICH µg/l	PCB µg/l	96-hr Bioassay % survival	Temp. °C	pH	Salinity ppt
30Jan79	1	1.7×10^6	1.3×10^5	124	0.2	<1	0.1[a]	0.1[b]	100	9.0	7.7	<1
	2	1.7×10^6	2.2×10^5	162	0.2	1	ND	1.1[c]	100	10.0	7.4	2
	3	9.4×10^2	4.9×10^1	32	0.3	<1	-	-	-	8.0	7.8	22
13Feb79	1	1.3×10^6	2.2×10^5	131	0.3	<1	ND	0.1[b]	100	12.5	6.3	0.04
	2	2.4×10^6	1.1×10^5	91	1.0	4	ND[c]	0.7[c]	0	12.0	6.1	0.06
	3	4.6×10^1	1.3×10^1	6	0.4	<1	-	-	-	12.0	8.0	22.4
20Feb79	1	4.9×10^5	7.0×10^4	102	0.4	<1	0.1[a]	0.3[c]	100	12.6	5.5	0.10
	2	1.3×10^6	7.9×10^5	44	0.1	<1	ND[c]	0.2[b] 0.1[c]	100	11.8	7.2	6.8
	3	1.3×10^3	2.3×10^2	8	<0.1	<1	-	-	-	12.0	8.1	20.1

[a]Technical chlordane; all others not detected (ND).

[b]PCB 1254.

[c]PCB 1260; presence of PCB 1260 interferes with low-level detection of PCB 1254 and technical chlordane.

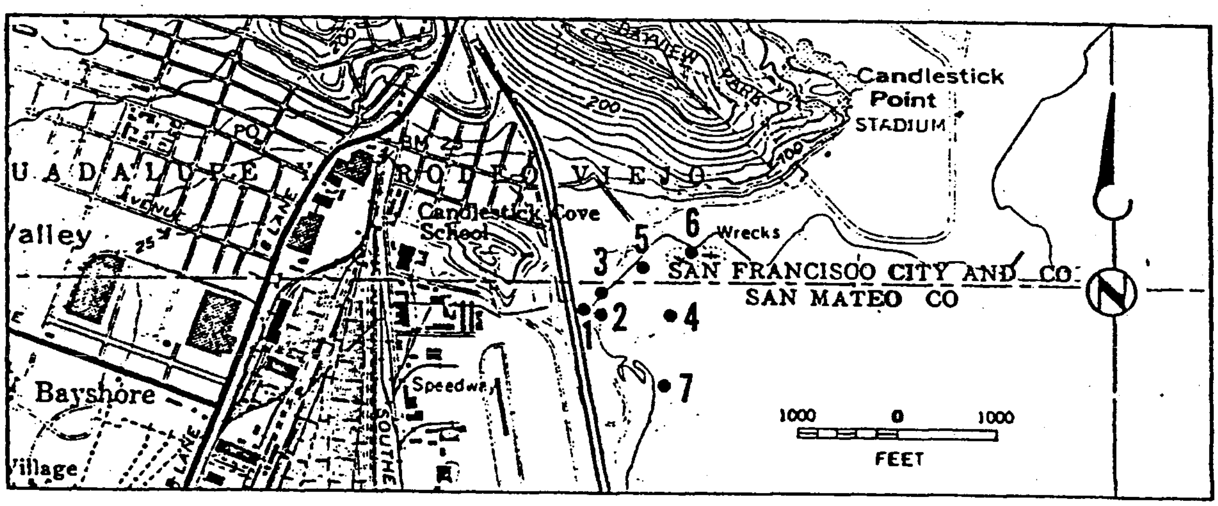


SUNNYDALE OUTFALL

SUPPLEMENTARY OVERFLOW MONITORING PROGRAM

Survey	Station	Total Coliforms MPN/100 ml	Fecal Coliforms MPN/100 ml	Pb µg/l	Hg µg/l	Cd µg/l	TICH µg/l	PCB µg/l	96-hr Bioassay % survival	Temp. °C	pH	Salinity ppt
30Jan79	1	7.9×10^6	7.9×10^5	234	<0.1	1	0.2[a]	0.4[b]	100	8.0	7.8	<1
	2	3.3×10^6	4.9×10^5	124	0.1	1	ND	ND	100	8.0	7.7	16
	3	-	-	-	-	-	-	-	-	-	-	-
	4	3.5×10^4	2.4×10^4	12	0.4	<1	-	-	-	9.0	7.6	27
	5	4.9×10^5	4.9×10^4	152	<0.1	<1	0.1[a]	0.2[b]	100	9.0	7.6	20
	6	1.3×10^4	1.7×10^3	57	<0.1	<1	-	-	-	7.5	7.8	22
	7	3.5×10^3	1.3×10^2	65	<0.1	<1	-	-	-	8.0	7.8	22
13Feb79	1	7.9×10^6	1.3×10^6	228	0.3	<1	0.1[a]	0.1[b]	100	12.0	6.5	0.04
	2	7.9×10^5	4.9×10^5	21	0.2	<1	ND	ND	100	11.5	7.7	15.0
	3	3.3×10^4	1.3×10^4	330	0.7	<1	ND	0.4[b]	100	12.5	7.2	0.08
	4	7.0×10^4	3.3×10^4	8	0.3	<1	-	-	-	12.0	7.8	20.3
	5	1.3×10^6	4.9×10^5	84	0.6	<1	-	-	-	11.5	7.5	15.0
	6	4.6×10^5	2.4×10^5	34	0.2	<1	-	-	-	11.5	7.6	17.0
	7	3.3×10^2	3.3×10^1	41	0.3	<1	-	-	-	11.5	7.7	21.0
20Feb79	1	1.7×10^6	2.2×10^5	112	0.3	<1	0.1[a]	0.1[b]	100	11.3	6.1	0.03
	2	3.5×10^6	2.3×10^5	143	0.6	<1	0.1[a]	0.2[b]	100	11.2	6.7	0.14
	3	1.1×10^5	4.9×10^3	140	0.5	<1	ND	0.1[b]	100	11.5	7.7	0.15
	4	2.4×10^5	1.3×10^4	52	0.3	<1	-	-	-	12.0	7.9	18.4
	5	5.4×10^6	2.3×10^5	22	9.5	<1	-	-	-	11.3	7.4	10.3
	6	1.3×10^5	7.9×10^3	12	<0.1	<1	-	-	-	11.4	8.1	20.7
	7	3.3×10^5	3.5×10^4	38	0.5	<1	-	-	-	11.2	7.9	16.6

[a]Technical chlordane; all others not detected (ND).
[b]PCB 1254.



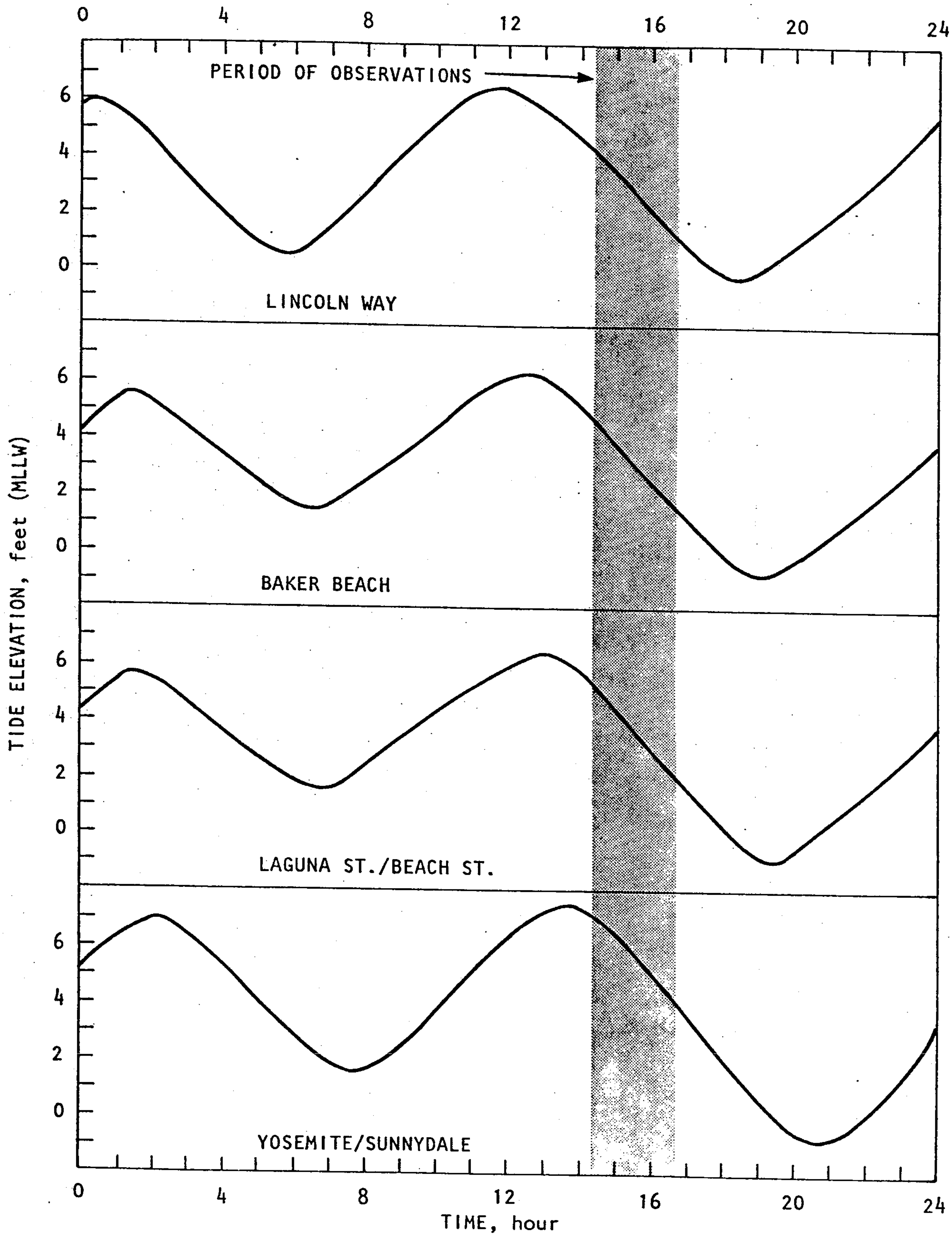


FIGURE 1. TIDAL CONDITIONS DURING FIRST SURVEY, JANUARY 30, 1979

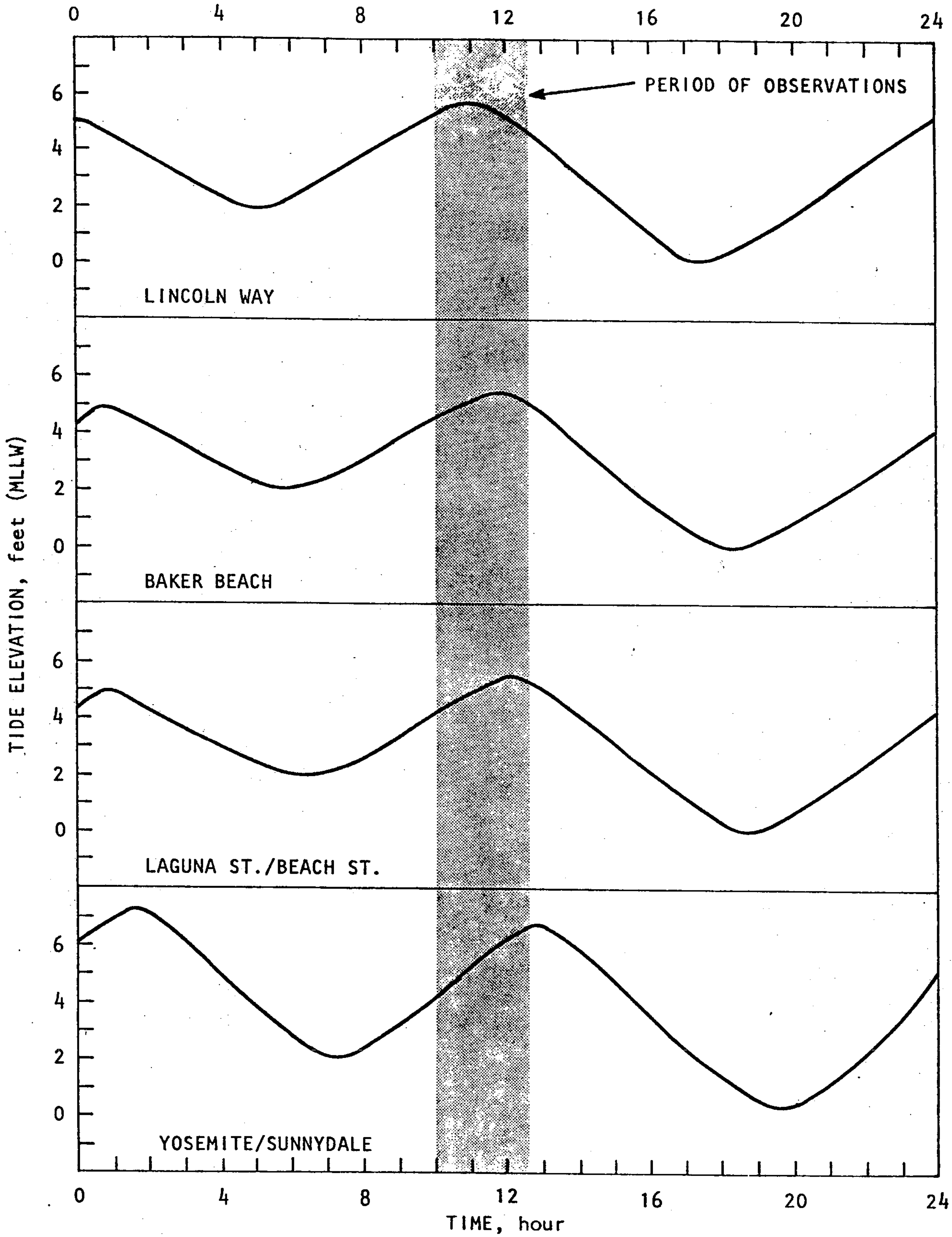


FIGURE 2. TIDAL CONDITIONS DURING SECOND SURVEY, FEBRUARY 13, 1979

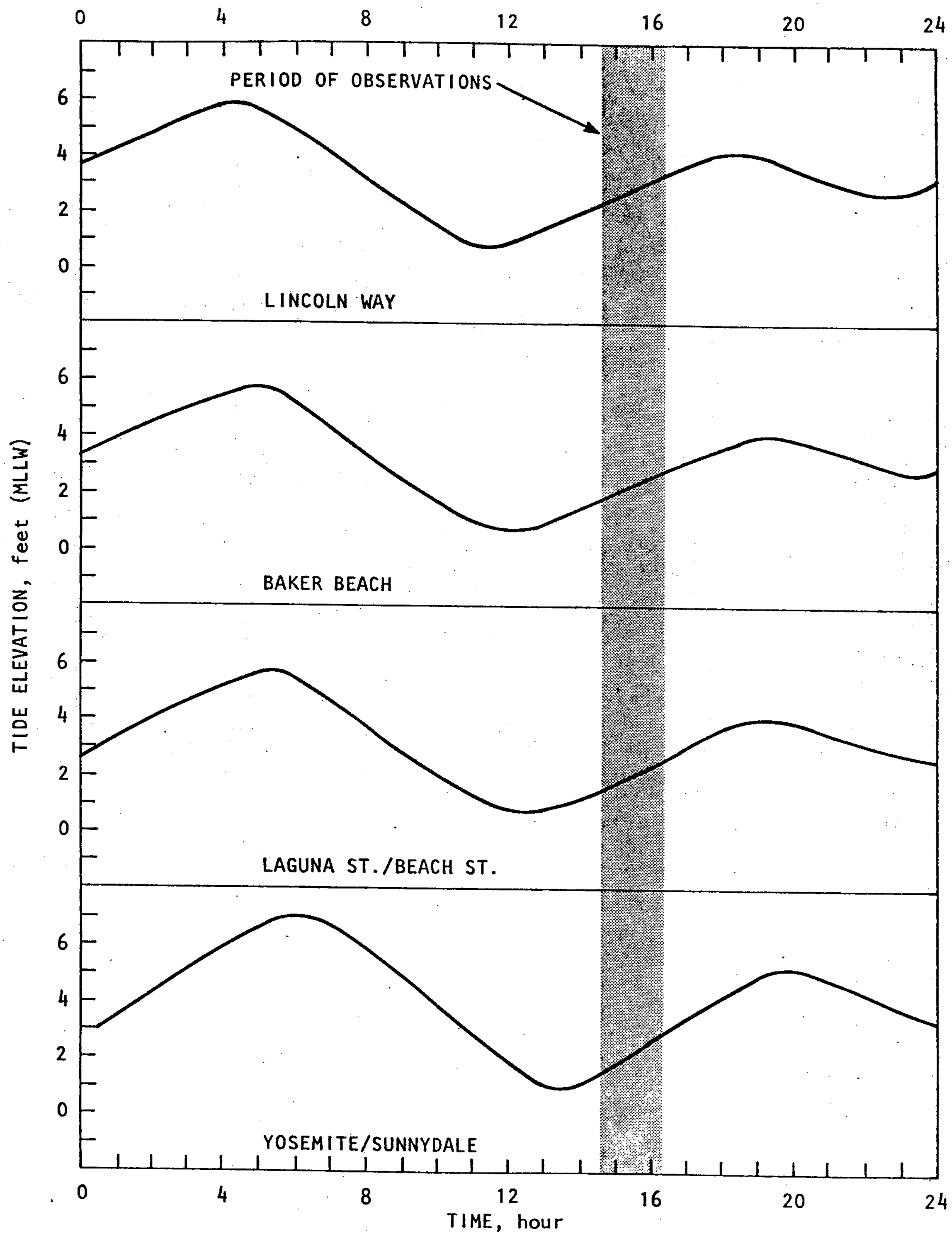


FIGURE 3. TIDAL CONDITIONS DURING THIRD SURVEY, FEBRUARY 20, 1979

APPENDIX C

INFLUENT DATA FROM 1973 PILOT PLANT STUDIES

SOUTHEAST STP INFLUENT ANALYSIS - HEAVY METALS

		MON 4/16		TUES 4/24		WED 4/18		THUR 4/26		FRI 4/20		SAT 4/28		SUN 4/22	
CONSTITUENT	UNIT	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP
ALUMINUM	UG/L	5,740	7,930	8,310	3,620	4,180	5,210	1,780	4,600	26,280	4,570	2,900	14,740	2,920	2,380
ANTIMONY	UG/L	100	130	130	17	40	70	270	250	120	170	140	200	170	130
ARSENIC	UG/L	3.6	4.4	4.2	4.4	4.4	7.4	4.3	3.2	2.2	6.5	4.5	5.4	3.6	3.9
BARIUM	UG/L	500	100	80	30	20	50	80	80	100	70	90	80	100	60
BERYLLIUM	UG/L	3.6	3.7	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	2.0	3.0
BISMUTH	UG/L	100	100	150	230	50	100	120	100	120	20	80	100	200	200
BORON	UG/L	570	790	620	720	630	200	890	1,470	340	910	120	1,110	580	600
CADMIUM	UG/L	3.0	2.0	5.0	4.0	6.0	4.0	3.7	2.5	3.4	2.6	4.0	2.0	2.0	1.0
CALCIUM	UG/L	58	54	43	50	43	43	63	60	43	50	38	50	46	46
CHROMIUM	UG/L	1,600	2,400	6,600	3,200	2,300	2,100	2,700	5,000	47	1,600	2,700	5,000	350	320
CR-6	UG/L	5	5	5	5	5	5	5	5	5	5	5	5	5	5
COBALT	UG/L	26.0	21.0	1.0	1.0	10.0	5.0	0.1	0.1	5.0	5.0	1.0	1.0	5.0	5.0
COPPER	UG/L	230	230	240	220	140	120	200	240	120	200	200	240	290	200
CYANIDE	MG/L	0.080	0.060	0.008	0.060	0.035	0.060	0.005	0.040	0.055	0.210	0.005	0.015	0.225	0.150
FE -2	UG/L	120	150	400	200	100	100	280	200	3,000	500	15,000	2,000	200	200
GOLD	UG/L	14.0	7.0	1.0	1.0	5.0	5.0	0.1	0.1	5.0	5.0	1.0	1.0	7.0	6.0
IRON	UG/L	3,830	4,950	6,230	2,170	1,040	1,390	4,010	7,360	8,000	4,570	16,080	8,290	1,170	1,590
LEAD	UG/L	200	190	200	130	98	95	130	130	86	760	130	130	71	50
LITHIUM	UG/L	10	10	15	15	10	14	23	20	12	15	15	18	17	15
MAGNESIUM	UG/L	153.10	138.70	62.34	126.62	67.92	104.30	145.00	128.80	57.14	109.77	40.63	119.78	140.00	139.10
MANGANESE	UG/L	160	160	180	220	150	160	160	190	200	180	160	190	180	180
MERCURY	UG/L	0.24	0.50	1.24	1.00	0.18	0.24	10.00	0.36	0.24	0.34	0.88	0.80	1.06	0.72
MOLYBDENUM	UG/L	20	20	10	18	10	17	220	18	11	18	12	18	20	20
NICKEL	UG/L	49	56	210	180	210	350	22	37	110	37	350	150	20	100
PHOSPORUS	UG/L	9,600	15,000	9,700	6,500	9,500	7,500	7,300	5,600	8,000	6,600	10,700	6,900	8,000	7,100
POTASSIUM	MG/L	62.0	69.0	32.0	41.0	17.0	35.0	63.0	38.0	51.0	64.0	37.0	54.0	49.0	51.0
SELENIUM	UG/L	10	10	8	4	10	10	23	41	10	10	24	14	10	10
SILICON	UG/L	28,710	39,630	17,660	6,330	7,310	9,560	7,810	11,040	30,860	18,300	5,220	4,610	5,830	4,970
SILVER	UG/L	37	25	31	28	16	14	33	36	25	37	33	36	48	33
SODIUM	MG/L	690	720	370	630	640	820	970	810	430	680	460	770	730	790
STRONTIUM	UG/L	570	790	310	360	310	520	450	550	340	370	460	550	390	400
THALLIUM	UG/L	200	200	100	180	100	170	220	180	110	180	120	180	200	200
TIN	UG/L	38	79	94	18	100	52	22	37	91	37	23	18	20	20
TITANIUM	UG/L	130	240	260	152	112	112	200	200	132	104	580	770	480	280
TUNGSTEN	UG/L	400	400	210	360	210	350	450	370	220	370	230	40	390	400
URANIUM	UG/L	9	10	2	1	3	6	6	6	1	4	4	2	3	7
VANADIUM	UG/L	50	50	10	10	10	10	10	10	10	10	10	10	10	10
ZINC	UG/L	1,550	650	940	430	430	560	780	920	3,500	1,200	48,000	4,000	240	270
ZIRCONIUM	UG/L	150	330	223	173	209	270	389	326	367	289	159	293	181	186

SOUTHEAST STP INFLUENT ANALYSIS - HEAVY METALS

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
ALUMINUM	UG/L	26,280	1,780	6,150
ANTIMONY	UG/L	270	17	138
ARSENIC	UG/L	7.4	2.2	5.0
BARIUM	UG/L	500	20	67
BERYLLIUM	UG/L	3.7	1.0	1.7
BISMUTH	UG/L	230	20	121
BORON	UG/L	1,470	120	829
CADMIUM	UG/L	6.0	1.0	2.6
CALCIUM	UG/L	63	38	50
CHROMIUM	UG/L	6,600	47	2,803
CR-6	UG/L	5	5	5
COBALT	UG/L	26.0	0.1	5.4
COPPER	UG/L	290	120	207
CYANIDE	MG/L	0.225	0.005	0.085
FE -2	UG/L	15,000	100	479
GOLD	UG/L	14.0	0.1	3.6
IRON	UG/L	16,080	1,040	4,331
LEAD	UG/L	760	50	212
LITHIUM	UG/L	23	10	15
MAGNESIUM	UG/L	153.10	40.63	123.87
MANGANESE	UG/L	220	150	183
MERCURY	UG/L	10.00	0.16	0.57
MOLYBDENUM	UG/L	220	10	18
NICKEL	UG/L	350	20	130
PHOSPORUS	UG/L	15,000	5,600	7,886
POTASSIUM	MG/L	69.0	17.0	50.3
SELENIUM	UG/L	41	4	14
SILICON	UG/L	39,630	4,610	13,491
SILVER	UG/L	48	14	30
SODIUM	MG/L	970	370	746
STRONTIUM	UG/L	790	310	506
THALLIUM	UG/L	220	100	184
TIN	UG/L	100	16	37
TITANIUM	UG/L	770	104	265
TUNGSTEN	UG/L	450	40	327
URANIUM	UG/L	10	1	5
VANADIUM	UG/L	80	10	16
ZINC	UG/L	48,000	240	1,147
ZIRCONIUM	UG/L	389	150	267

SOUTHEAST STP INFLUENT ANALYSIS - PHYSICAL - 1973

		MON 4/16		TUES 4/24		WED 4/18		THUR 4/26		FRI 4/20		SAT 4/28		SUN 4/22	
CONSTITUENT	UNIT	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP
COLOR	UNITS	210	168	145	75	195	145	145	125	180	125	165	125	90	80
CONDUCT.	U-MHO	4,800	5,000	2,160	4,280	3,250	4,610	5,220	4,280	2,290	4,800	2,960	4,800	5,220	4,800
FLOATABLES	MG/L	2.70	3.60	5.50	7.00	4.51	79.60	18.00	33.00	5.90	7.60	3.80	4.40	5.10	6.20
ODOR-RM T	TH-NO.	1023.0	545.0	5000.0	4656.0	9850.0	1700.0	5745.0	5347.0	7580.0	2550.0	1546.0	2464.5	532.0	9935.0
SETTLEABLE	MG/L	7.0	2.5	10.0	5.0	8.0	6.0	6.0	5.0	5.5	6.0	13.0	6.0	11.0	2.0
TOT DIS SOL	MG/L	2,240	2,430	1,210	1,770	1,540	2,160	2,940	2,160	1,114	1,970	1,470	2,180	2,398	1,972
TOT SOLIDS	MG/L	2,540	2,700	1,620	2,050	1,860	2,460	3,400	2,530	1,490	2,330	1,833	2,490	2,634	2,122
TOT SUS MAT	MG/L	300	262	402	272	326	301	462	373	376	354	365	315	235	150
TOT VOL SOL	MG/L	649	644	489	556	511	490	826	677	563	605	644	558	567	441
TURBIDITY	JTU	210	228	260	210	220	230	220	210	215	200	260	200	180	100
VOL SUS MAT	MG/L	253	222	326	230	280	254	380	310	297	270	266	222	203	136
TEMPERATURE	DEG-C	18.6	20.0	19.5	20.5	18.5	19.5	19.0	20.0	29.5	20.0	18.0	19.5	19.0	20.5

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SOUTHEAST STP INFLUENT ANALYSIS - PHYSICAL

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
COLOR	UNITS	210	75	120
CONDUCT.	U-MHO	5,220	2,160	4,653
FLOATABLES	MG/L	79.60	2.70	20.20
ODOR-RM T	TH-NO.	112,550.0	532.0	23,885.4
SETTLEABLE	MG/L	13.0	2.0	4.6
TOT DIS SOL	MG/L	2,940	1,114	2,092
TOT SOLIDS	MG/L	3,400	1,490	2,383
TOT SUS MAT	MG/L	462	150	290
TOT VOL SOL	MG/L	826	441	567
TURBIDITY	JTU	260	100	197
VOL SUS MAT	MG/L	380	136	235
TEMPERATURE	DEG-C	29.5	18.0	20.0

SOUTHEAST STP INFLUENT ANALYSIS - CHEMICAL AND BIOCHEMICAL - 1973

		MON 4/16		TUES 4/24		WED 4/18		THUR 4/26		FRI 4/20		SAT 4/28		SUN 4/22	
CONSTITUENT	UNIT	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP
ACID(CACO3)	MG/L	42.9	45.2	19.0	33.0	105.0	48.0	28.0	24.0	8.2	21.0	165.0	22.0	15.0	16.0
ALKA(CACO3)	MG/L	186	179	222	164	120	172	172	184	266	177	72	177	196	172
BOD(5 DAY)	MG/L	329	192	299	222	278	412	299	254	380	262	214	176	133	126
BOD(ULTIM)	MG/L	690	550	390	320	1,300	690	580	420	1,200	800	480	450	420	420
BROMIDE	MG/L	2.90	13.00	0.20	0.15	0.10	0.10	6.70	4.60	2.00	3.40	0.10	0.10	2.00	1.90
CO2	MG/L	37.7	40.0	17.0	29.0	93.0	51.0	25.0	21.0	7.2	19.0	145.0	19.0	1.3	14.0
CHLORIDE	MG/L	1,010	1,000	344	979	430	1,020	1,250	946	326	914	491	994	1,040	1,040
COD	MG/L	1,170	1,140	719	651	1,550	675	876	1,310	856	471	593	488	558	736
DIS OXY	MG/L	0.75	2.00	0.00	2.10	2.90	2.90	0.30	2.40	3.10	4.30	0.10	2.10	0.30	2.50
FLUORIDE	MG/L	1.55	0.98	1.05	0.84	1.00	0.94	1.08	1.00	1.05	0.86	1.03	0.60	0.84	0.70
IODIDE	MG/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.010	0.018	0.001	0.001	0.001	0.001
OIL-GR(TOT)	MG/L	91.6	116.9	89.0	61.0	71.8	92.9	37.0	58.0	51.0	45.0	71.0	61.0	45.0	58.0
PH	UNIT	7.8000	8.7000	8.2500	9.0000	6.9000	8.9000	7.2500	8.4000	8.4000	8.6000	6.2500	9.9200	7.4000	7.6000
PHENOLS	MG/L	0.180	0.300	0.115	0.054	0.520	0.935	1.975	0.583	0.125	0.190	0.125	0.160	0.120	0.200
SULFATE	MG/L	240	230	156	236	296	220	260	240	196	250	390	300	212	218
SULFIDE	MG/L	1.50	0.80	2.80	0.60	1.80	0.35	0.90	0.80	3.80	1.10	0.58	0.94	0.22	0.32
SULFITE	MG/L	6.4	6.0	13.0	5.3	12.0	2.8	3.0	4.0	9.2	4.0	2.1	2.5	2.0	2.0
SURFACTANTS	MG/L	6.0	6.6	7.5	7.5	7.3	8.6	6.5	6.9	7.4	7.1	7.3	9.3	6.5	6.1
TOT HARD	MG/L	500	460	210	400	300	450	560	460	250	420	260	450	500	490
TOT ORG CAR	MG/L	205	175	285	204	174	353	167	178	263	149	156	110	78	80

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SOUTHEAST STP INFLUENT ANALYSIS - CHEMICAL AND BIOCHEMICAL

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
ACID(CACO3)	MG/L	165.0	8.2	29.9
ALKA(CACO3)	MG/L	266	72	175
BOD(5 DAY)	MG/L	412	126	235
BOD(ULTIM)	MG/L	1,300	320	521
BROMIDE	MG/L	13.00	0.10	3.32
CO2	MG/L	145.0	1.3	27.6
CHLORIDE	MG/L	1,250	326	985
COD	MG/L	1,550	471	782
DIS OXY	MG/L	4.30	0.00	2.61
FLUORIDE	MG/L	1.55	0.60	0.85
IODIDE	MG/L	0.018	0.001	0.003
OIL-GR(TOT)	MG/L	116.9	37.0	70.4
PH	UNIT	9.9200	6.2500	8.7314
PHENOLS	MG/L	1.975	0.054	0.346
SULFATE	MG/L	390	156	242
SULFIDE	MG/L	3.80	0.22	0.70
SULFITE	MG/L	13.0	2.0	3.8
SURFACTANTS	MG/L	9.3	6.0	7.4
TOT HARD	MG/L	560	210	459
TOT ORG CAR	MG/L	353	78	178

SOUTHEAST STP - INFLUENT ANALYSIS - NUTRIENTS - 1973

		MON 4/16		TUES 4/24		WED 4/18		THUR 4/26		FRI 4/20		SAT 4/28		SUN 4/22	
CONSTITUENT	UNIT	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP
AMMONIA-N	MG/L	20.0	14.0	22.0	16.0	16.6	13.0	14.0	11.2	22.0	14.0	40.0	29.0	21.0	12.0
NITRATE-N	MG/L	0.40	1.20	0.02	0.01	0.02	0.13	0.27	0.31	0.09	0.12	0.39	0.52	0.04	0.15
NITRITE-N	MG/L	0.01	0.01	0.01	0.06	0.01	0.19	0.01	0.02	0.01	0.61	0.11	0.15	0.01	0.16
ORGANIC-N	MG/L	34.0	14.0	8.0	24.0	43.4	25.0	16.0	19.0	48.0	27.0	30.0	23.0	18.0	19.0
TOTAL N	MG/L	54	28	30	40	60	38	25	30	70	41	70	52	39	31
ORTHO-P	MG/L	4.5	3.6	6.0	3.7	6.0	3.5	4.8	3.3	5.1	4.0	0.5	0.9	4.9	3.4
TOTAL-P	MG/L	9.6	15.0	9.7	6.5	9.9	7.5	7.3	5.6	9.1	6.6	10.7	6.9	8.0	7.1

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SOUTHEAST STP - INFLUENT ANALYSIS - NUTRIENTS

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
AMMONIA-N	MG/L	40.0	11.2	15.6
NITRATE-N	MG/L	1.20	0.01	0.35
NITRITE-N	MG/L	0.61	0.01	0.17
ORGANIC-N	MG/L	48.0	8.0	21.6
TOTAL N	MG/L	70	25	37
ORTHO-P	MG/L	6.0	0.5	3.2
TOTAL-P	MG/L	15.0	5.6	7.9

SOUTHEAST STP - INFLUENT ANALYSIS - BIOASSAYS - 1973

		MON 4/16		TUES 4/24		WED 4/18		THUR 4/26		FRI 4/20		SAT 4/28		SUN 4/22	
CONSTITUENT	UNIT	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP
TLM-24 HR	%	67	87	35		37	90			61	86	86		61	88
TLM-48 HR	%	61	87	35		37	90			61	86	86		61	85
TLM-96 HR	%	59	87	35		37	90			61	86	81		51	81
SURVIVAL-24	%	0	0	0	100	0	20	90	80	0	0	0	100	0	10
SURVIVAL-48	%	0	0	0	100	0	20	90	70	0	0	0	100	0	0
SURVIVAL-96	%	0	0	0	80	0	20	60	70	0	0	0	100	0	0
TOXICITY	UNITS	1.69	1.15	2.86	0.77	2.70	1.11	0.94	0.87	1.64	1.16	1.23	0.00	1.64	1.23

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SOUTHEAST STP - INFLUENT ANALYSIS - BIOASSAYS

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
TLM-24 HR	%	90	35	88
TLM-48 HR	%	90	35	87
TLM-96 HR	%	90	35	86
SURVIVAL-24	%	100	0	44
SURVIVAL-48	%	100	0	41
SURVIVAL-96	%	100	0	39
TOXICITY	UNITS	2.86	0.00	0.90

		MON 4/16		TUES 4/24		WED 4/18		THUR 4/26		FRI 4/20		SAT 4/28		SUN 4/22	
CONSTITUENT	UNIT	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP
GROSS ALPHA	PC/L	19	16	10	18	10	10	70	21	12	17	25	70	21	19
GROSS BETA	PC/L	76	49	38	176	33	40	74	68	37	77	56	95	87	92
RADIUM 226	PC/L	0.09	0.09	0.20	0.10	0.20	0.04	0.13	0.14	0.02	0.05	0.09	0.20	0.16	0.20
STRONT. 90	PC/L	0.5	0.5	0.5	0.5	0.5	1.0	0.6	0.5	0.5	1.0	0.5	0.5	0.6	0.5

SOUTHEAST STP - INFLUENT ANALYSIS - RADIOACTIVE SUBSTANCES

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
GROSS ALPHA	PC/L	70	10	24
GROSS BETA	PC/L	176	33	85
RADIUM 226	PC/L	0.20	0.02	0.12
STRONT. 90	PC/L	1.0	0.5	0.6

SOUTHEAST STP INFLUENT ANALYSIS - CHLORINATED HYDROCARBONS - 1973

		MON 4/16		TUES 4/24		WED 4/18		THUR 4/26		FRI 4/20		SAT 4/28		SUN 4/22	
CONSTITUENT	UNIT	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP
LINDANE	UG/L	0.005	0.003	0.306	0.001	0.053	0.007	0.001	0.006	0.123	0.078	0.001	0.001	0.038	0.056
HPT-CL-EPOX	UG/L	0.001	0.001	0.001	0.007	0.001	0.001	0.002	0.001	0.001	0.001	0.003	0.001	0.001	0.001
DDE	UG/L	0.001	0.002	0.017	0.019	0.001	0.020	0.014	0.009	0.045	0.029	0.002	0.004	0.001	0.001
DDD	UG/L	0.001	0.003	0.001	0.001	0.003	0.037	0.001	0.001	0.001	0.001	0.005	0.007	0.001	0.001
DDT	UG/L	0.007	0.033	0.001	0.001	0.010	0.055	0.074	0.060	0.001	0.001	0.023	0.033	0.050	0.113
DIELDRIN	UG/L	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.025	0.001	0.001	0.001	0.001
TOT CL H.C.	UG/L	0.480	0.750	0.708	0.632	4.160	1.884	2.079	0.382	9.211	1.265	1.432	1.960	0.975	1.212
ALDRIN	UG/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
CHLORDANE	UG/L	0.001	0.035	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.006	0.001	0.001
ENDRIN	UG/L	0.001	0.006	0.023	0.011	0.001	0.001	0.011	0.006	1.000	0.001	0.001	0.001	0.001	0.001
HEPTACHLOR	UG/L	0.020	0.001	0.001	0.001	0.018	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
METHOXYCHLO	UG/L	0.001	0.001	0.001	0.001	0.001	0.013	0.011	0.015	0.028	0.012	0.003	0.002	0.056	0.028
TOXAPHENE	UG/L	0.005	0.015	0.001	0.001	0.001	0.040	0.148	0.001	0.050	0.032	0.003	1.000	0.010	0.014
ORG PHOSPH	UG/L	4.078	16.214	0.611	0.530	4.760	0.515	1.146	0.252	0.476	0.160	0.146	0.246	0.316	0.197
2-4-D	UG/L	1.250	0.259	0.113	0.100	4.063	1.463	0.858	0.183	1.796	0.894	0.210	0.122	0.867	0.834
PCB	UG/L	0.133	0.403	0.050	0.451	3.982	1.541	0.072	0.002	0.161	0.167	0.041	0.047	0.014	0.095
CARBAMATES	UG/L	0.001	0.001	0.018	0.031	0.046	0.011	0.121	0.027	0.152	0.001	0.001	0.041	0.001	0.012

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SOUTHEAST STP INFLUENT ANALYSIS - CHLORINATED HYDROCARBONS

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
LINDANE	UG/L	0.306	0.001	0.022
HPT-CL-EPOX	UG/L	0.007	0.001	0.002
DDE	UG/L	0.045	0.001	0.012
DDD	UG/L	0.037	0.001	0.007
DDT	UG/L	0.113	0.001	0.042
DIELDRIN	UG/L	0.025	0.001	0.005
TOT CL H.C.	UG/L	9.211	0.382	1.155
ALDRIN	UG/L	0.001	0.001	0.001
CHLORDANE	UG/L	0.035	0.001	0.007
ENDRIN	UG/L	1.000	0.001	0.004
HEPTACHLOR	UG/L	0.020	0.001	0.001
METHOXYCHLO	UG/L	0.056	0.001	0.010
TOXAPHENE	UG/L	1.000	0.001	0.158
ORG PHOSPH	UG/L	16.214	0.146	2.588
2-4-D	UG/L	4.063	0.100	0.551
PCB	UG/L	3.982	0.002	0.387
CARBAMATES	UG/L	0.152	0.001	0.018

NORTHPOINT STP INFLUENT ANALYSIS - HEAVY METALS

CONSTITUENT	UNIT	MON 4/16 GRAB	MON 4/16 COMP	TUES 4/24 GRAB	TUES 4/24 COMP	WED 4/18 GRAB	WED 4/18 COMP	THUR 4/26 GRAB	THUR 4/26 COMP	FRI 4/20 GRAB	FRI 4/20 COMP	SAT 4/28 GRAB	SAT 4/28 COMP	SUN 4/22 GRAB	SUN 4/22 COMP
ALUMINUM	UG/L	2,220	2,000	3,180	5,960	4,370	2,540	2,550	1,140	4,480	1,710	3,490	2,050	2,730	2,110
ANTIMONY	UG/L	30	50	30	70	20	20	100	100	40	50	80	120	50	80
ARSENIC	UG/L	5.4	5.7	4.0	3.9	11.3	3.2	4.1	3.7	11.5	8.7	2.3	4.9	0.7	1.6
BARIUM	UG/L	400	300	50	80	200	10	130	120	150	70	80	80	80	50
BERYLLIUM	UG/L	2.3	7.3	1.0	1.0	1.2	1.6	1.0	1.0	1.0	1.0	1.0	1.0	2.0	4.0
BISMUTH	UG/L	10	10	130	190	50	60	30	30	100	100	50	50	50	100
BORON	UG/L	220	320	450	740	440	640	590	610	160	410	500	270	410	1,260
CADMIUM	UG/L	6.0	4.0	6.0	5.2	3.0	7.0	68.0	12.0	7.4	2.6	68.0	12.0	1.0	11.0
CALCIUM	UG/L	23	26	23	28	21	25	24	30	19	25	21	26	19	26
CHROMIUM	UG/L	30	18	1,100	780	67	50	83	49	58	57	83	49	42	32
CR-6	UG/L	5.0	5.0	180.0	80.0	5.0	5.0	0.5	5.0	5.0	5.0	5.0	5.0	5.0	5.0
COBALT	UG/L	7.0	10.0	1.0	1.0	5.0	5.0	0.1	0.1	5.0	5.0	1.0	1.0	14.0	5.0
COPPER	UG/L	410	260	320	480	3,200	3,100	140	170	800	250	140	170	220	200
CYANIDE	MG/L	50,000	0.060	0.008	0.005	0.013	0.023	0.005	0.030	1,830	0.148	0.008	0.040	0.030	0.068
FE -2	UG/L	150	80	200	100	100	100	150	130	200	400	100	150	300	400
GOLD	UG/L	8.0	6.0	1.0	1.0	5.0	5.0	0.1	0.1	5.0	5.0	1.0	1.0	3.0	5.0
IRON	UG/L	2,780	1,200	1,120	1,860	1,640	1,590	2,970	1,900	1,750	1,710	3,490	4,100	1,500	2,530
LEAD	UG/L	50	53	120	110	440	74	160	110	94	51	160	110	520	30
LITHIUM	UG/L	10	5	12	11	11	100	10	10	10	100	12	10	5	5
MAGNESIUM	UG/L	33.36	56.10	22.44	52.12	21.86	41.34	21.25	53.12	20.78	44.50	24.91	41.00	17.75	59.02
MANGANESE	UG/L	71	70	80	100	64	70	80	85	91	68	80	85	61	69
MERCURY	UG/L	0.48	0.68	0.70	0.82	0.88	0.72	1.46	1.34	1.08	0.48	0.70	0.68	1.06	0.84
MOLYBDENUM	UG/L	6	8	4	7	4	6	4	8	3	7	5	7	3	8
NICKEL	UG/L	16	13	37	37	73	19	34	6	64	27	100	20	14	170
PHOSPORUS	UG/L	7,200	5,900	7,100	6,000	7,200	6,900	6,300	5,300	8,500	6,100	8,400	6,700	8,500	6,300
POTASSIUM	MG/L	0.26	31.00	25.00	30.00	12.00	13.00	16.00	22.00	32.00	34.00	22.00	32.00	16.00	26.00
SELENIUM	UG/L	10	100	14	2	10	10	50	39	30	40	7	13	10	10
SILICON	UG/L	8,340	7,210	11,590	16,380	15,300	13,560	11,050	6,630	17,260	8,210	14,950	8,200	8,190	6,750
SILVER	UG/L	52	29	110	78	43	37	47	58	130	41	47	58	390	35
SODIUM	MG/L	360	475	100	220	290	440	390	510	100	320	220	320	110	320
STRONTIUM	UG/L	220	320	150	370	180	250	130	150	180	140	250	200	110	170
THALLIUM	UG/L	60	80	40	70	40	60	80	40	30	70	50	70	30	60
TIN	UG/L	11	8	11	15	10	60	8	8	6	7	15	7	5	8
TITANIUM	UG/L	130	36	78	61	49	30	55	49	68	60	20	20	24	32
TUNGSTEN	UG/L	110	200	70	150	70	120	20	150	60	140	100	140	50	170
URANIUM	UG/L	3.0	5.0	0.9	2.0	1.0	4.0	5.0	6.0	2.0	3.0	3.0	3.0	1.0	2.0
VANADIUM	UG/L	50	50	10	10	10	10	10	10	10	10	10	10	10	10
ZINC	UG/L	430	400	240	270	410	440	310	450	420	320	310	280	310	270
ZIRCONIUM	UG/L	130	110	121	104	214	159	214	196	241	251	117	80	173	146

NORTHPOINT STP INFLUENT ANALYSIS - HEAVY METALS

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
ALUMINUM	UG/L	5,960	1,140	2,501
ANTIMONY	UG/L	120	20	70
ARSENIC	UG/L	11.5	0.7	4.5
BARIUM	UG/L	400	10	101
BERYLLIUM	UG/L	7.3	1.0	2.4
BISMUTH	UG/L	190	10	77
BORON	UG/L	1,260	160	607
CADMIUM	UG/L	68.0	1.0	7.7
CALCIUM	UG/L	30	19	27
CHROMIUM	UG/L	1,100	18	148
CR-6	UG/L	180.0	0.5	15.7
COBALT	UG/L	14.0	0.1	3.9
COPPER	UG/L	3,200	140	661
CYANIDE	MG/L	50.000	0.005	0.053
FE +2	UG/L	400	80	194
GOLD	UG/L	8.0	0.1	3.3
IRON	UG/L	4,100	1,120	2,127
LEAD	UG/L	520	30	77
LITHIUM	UG/L	100	5	34
MAGNESIUM	UG/L	59.02	17.75	49.60
MANGANESE	UG/L	100	61	78
MERCURY	UG/L	1.46	0.48	0.79
MOLYBDENUM	UG/L	8	3	7
NICKEL	UG/L	170	6	42
PHOSPORUS	UG/L	8,500	5,300	6,171
POTASSIUM	MG/L	34.00	0.26	26.86
SELENIUM	UG/L	100	2	51
SILICON	UG/L	17,260	6,750	9,591
SILVER	UG/L	390	29	48
SODIUM	MG/L	510	100	372
STRONTIUM	UG/L	470	110	229
THALLIUM	UG/L	80	50	67
TIN	UG/L	60	5	16
TITANIUM	UG/L	130	20	41
TUNGSTEN	UG/L	200	20	153
URANIUM	UG/L	6.0	0.9	3.6
VANADIUM	UG/L	50	10	16
ZINC	UG/L	450	240	347
ZIRCONIUM	UG/L	251	80	149

NORTHPOINT STP INFLUENT ANALYSIS - PHYSICAL - 1973

CONSTITUENT	UNIT	MON 4/16 GRAB	MON 4/16 COMP	TUES 4/24 GRAB	TUES 4/24 COMP	WED 4/18 GRAB	WED 4/18 COMP	THUR 4/26 GRAB	THUR 4/26 COMP	FRI 4/20 GRAB	FRI 4/20 COMP	SAT 4/28 GRAB	SAT 4/28 COMP	SUN 4/22 GRAB	SUN 4/22 COMP
COLOR	UNITS	138	96	90	60	125	80	90	60	105	60	90	70	75	60
CONDUCT.	U-MHO	1,620	2,000	682	1,670	100	1,670	1,070	1,670	938	1,710	1,250	1,880	789	2,001
FLOATABLES	MG/L	3.2	4.6	10.0	6.9	5.2	5.3	2.4	3.1	4.0	3.5	2.8	3.5	7.8	2.6
ODOR-RM T	TH-NO.	1134.0	537.5	4656.0	4310.0	6750.0	7600.0	6792.5	6141.5	2600.0	4915.0	2860.0	4656.5	2461.0	6300.0
SETTLEABLE	MG/L	12.0	3.1	18.0	6.0	9.0	4.0	4.5	9.0	3.0	4.0	4.0	7.0	4.0	2.0
TOT DIS SOL	MG/L	745.0	1010.0	470.0	931.0	507.0	825.0	554.0	790.0	512.0	810.0	596.0	869.0	386.0	933.5
TOT SOLIDS	MG/L	269	1,160	950	1,080	734	967	716	990	665	989	731	1,077	547	1,041
TOT SUS MAT	MG/L	269.0	145.0	480.0	148.0	227.0	142.0	162.0	210.0	153.0	179.0	135.0	208.0	161.1	107.1
TOT VOL SOL	MG/L	493	339	533	344	314	246	308	310	320	316	256	338	239	230
TURBIDITY	JTU	198	174	240	135	240	135.	145	125	115	120	125	120	110	70
VOL SUS MAT	MG/L	231.0	135.0	422.0	134.0	200.0	129.0	138.0	180.0	141.0	157.0	125.0	186.0	146.4	100.5
TEMPERATURE	DEG-C	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	21.5	22.0	21.0	21.0	21.5	22.0

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NORTHPOINT STP INFLUENT ANALYSIS - PHYSICAL

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
COLOR	UNITS	138	60	69
CONDUCT.	U-MHO	2,001	100	1,800
FLOATABLES	MG/L	10.0	2.4	4.2
ODOR-RM T	TH-NO.	24,915.0	537.5	7,780.1
SETTLEABLE	MG/L	18.0	2.0	5.0
TOT DIS SOL	MG/L	1,010.0	386.0	881.2
TOT SOLIDS	MG/L	1,160	269	1,043
TOT SUS MAT	MG/L	480.0	107.1	162.7
TOT VOL SOL	MG/L	533	230	303
TURBIDITY	JTU	240	70	126
VOL SUS MAT	MG/L	422.0	100.5	145.9
TEMPERATURE	DEG-C	22.0	21.0	21.9

NORTHPOINT STP INFLUENT ANALYSIS - CHEMICAL AND BIOCHEMICAL - 1973

		MON 4/16		TUES 4/24		WED 4/18		THUR 4/26		FRI 4/20		SAT 4/28		SUN 4/22	
CONSTITUENT	UNIT	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP
ACID(CACO3)	MG/L	26.1	27.0	20.0	16.0	38.0	26.4	1.0	23.0	36.0	31.0	18.0	24.0	12.0	12.0
ALKA(CACO3)	MG/L	160	156	157	142	151	148	209	145	134	140	155	138	145	133
BOD(5 DAY)	MG/L	222	211	166	150	217	206	135	174	282	219	186	130	152	140
BOD(ULTIM)	MG/L	620	460	260	320	830	380	220	340	930	500	380	330	370	370
BROMIDE	MG/L	0.10	0.10	0.10	0.10	0.10	0.15	0.45	2.60	0.10	0.10	0.10	0.35	0.10	1.40
CO2	MG/L	23.00	24.00	17.00	14.00	34.00	23.00	1.00	20.00	32.00	27.00	16.00	21.00	1.06	10.20
CHLORIDE	MG/L	249	389	122	353	146	334	138	338	81	403	212	378	80	370
COD	MG/L	696	672	566	363	471	384	474	453	674	681	404	388	423	363
DIS OXY	MG/L	1.12	2.17	1.20	3.70	0.68	2.00	1.50	2.10	1.20	2.00	0.50	4.30	1.60	2.70
FLUORIDE	MG/L	1.50	1.00	1.28	1.08	1.52	1.20	1.28	1.18	1.40	1.10	1.10	0.82	0.84	0.84
IODINE	MG/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.010	0.010	0.001	0.001	0.032	0.003
OIL-GR(TOT)	MG/L	136.1	220.4	47.0	56.0	65.1	121.3	20.0	43.0	84.0	88.0	51.0	66.0	39.0	74.0
PH	UNIT	7.8	9.3	7.7	8.0	7.9	6.5	9.3	9.4	7.4	8.7	7.5	9.6	7.4	7.9
PHENOLS	MG/L	0.100	0.050	0.205	0.056	0.040	0.040	0.085	0.072	0.055	0.035	0.065	0.030	0.025	0.020
SULFATE	MG/L	66	84	28	68	22	75	39	78	33	76	56	83	34	80
SULFIDE	MG/L	0.40	0.30	0.80	0.60	0.32	0.27	6.80	0.61	0.48	0.53	0.37	0.34	0.42	0.40
SULFITE	MG/L	2.9	4.0	2.4	2.3	3.7	2.3	3.5	2.5	3.7	2.0	2.2	2.6	2.3	2.3
SURFACTANTS	MG/L	4.3	4.6	7.6	7.5	4.3	9.6	4.9	7.3	6.3	5.4	8.0	7.1	5.5	5.1
TOT HARD	MG/L	160	220	120	140	110	195	120	200	110	200	190	210	100	220
TOT ORG CAR	MG/L	132	140	103	124	116	110	114	88	108	106	126	116	90	67

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NORTHPOINT STP INFLUFNT ANALYSIS - CHEMICAL AND BIOCHEMICAL

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
ACID(CACO3)	MG/L	38.0	1.0	22.8
ALKA(CACO3)	MG/L	209	133	143
BOD(5 DAY)	MG/L	282	130	176
BOD(ULTIM)	MG/L	930	220	386
BROMIDE	MG/L	2.60	0.10	0.69
CO2	MG/L	34.00	1.00	19.89
CHLORIDE	MG/L	403	80	366
COD	MG/L	696	363	472
DIS OXY	MG/L	4.30	0.50	2.71
FLUORIDE	MG/L	1.52	0.82	1.03
IODIDE	MG/L	0.032	0.001	0.003
OIL-GR(TOT)	MG/L	220.4	20.0	95.5
PH	UNIT	9.6	7.4	8.8
PHENOLS	MG/L	0.205	0.020	0.043
SULFATE	MG/L	84	22	78
SULFIDE	MG/L	6.80	0.27	0.44
SULFITE	MG/L	4.0	2.0	2.6
SURFACTANTS	MG/L	9.6	4.3	6.7
TOT HARD	MG/L	220	100	198
TOT ORG CAR	MG/L	140	67	107

NORTHPOINT STP - INFLUENT ANALYSIS - NUTRIENTS - 1973

		MON 4/16		TUES 4/24		WED 4/18		THUR 4/26		FRI 4/20		SAT 4/28		SUN 4/22	
CONSTITUENT	UNIT	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP
AMMONIA-N	MG/L	18.0	12.0	18.0	14.0	12.0	8.8	14.0	12.0	12.0	10.0	30.0	20.0	14.0	9.6
NITRATE-N	MG/L	0.59	0.15	0.05	0.27	0.16	0.17	0.26	0.24	0.04	0.10	0.34	0.16	0.15	0.26
NITRITE-N	MG/L	0.01	0.01	0.01	0.07	0.01	0.08	0.84	0.01	0.02	0.01	0.01	0.01	0.01	0.16
ORGANIC-N	MG/L	14.0	33.0	20.0	28.0	30.0	7.2	7.4	7.0	31.0	12.0	14.0	15.0	7.5	39.0
TOTAL N	MG/L	32	45	38	42	42	16	21	19	43	22	44	35	22	49
ORTHO-P	MG/L	4.0	3.2	4.4	3.7	4.6	3.7	3.8	3.4	6.3	3.4	6.2	4.7	4.6	3.2
TOTAL-P	MG/L	7.2	5.9	7.1	6.0	7.2	6.9	6.3	5.3	8.5	6.1	8.4	6.7	8.5	6.3

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NORTHPOINT STP - INFLUENT ANALYSIS - NUTRIENTS

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
AMMONIA-N	MG/L	30.0	8.8	12.3
NITRATE-N	MG/L	0.59	0.04	0.19
NITRITE-N	MG/L	0.84	0.01	0.05
ORGANIC-N	MG/L	39.0	7.0	20.2
TOTAL N	MG/L	49	16	33
ORTHO-P	MG/L	6.3	3.2	3.6
TOTAL-P	MG/L	8.5	5.3	6.2

NORTHPOINT STP - INFLUENT ANALYSIS - BIOASSAYS - 1973

CONSTITUENT	UNIT	MON 4/16 GRAB	MON 4/16 COMP	TUES 4/24 GRAB	TUES 4/24 COMP	WED 4/18 GRAB	WED 4/18 COMP	THUR 4/26 GRAB	THUR 4/26 COMP	FRI 4/20 GRAB	FRI 4/20 COMP	SAT 4/28 GRAB	SAT 4/28 COMP	SUN 4/22 GRAB	SUN 4/22 COMP
TLM-24 HR	%	62			63	65				35	86	61	88	92	78
TLM-48 HR	%	62			63	65	10			35	86	61	88	90	78
TLM-96 HR	%	62			61	65	96	83		35	86	61	88	86	78
SURVIVAL-24	%	0	100	100	0	0	80	80	100	0	0	0	10	30	0
SURVIVAL-48	%	0	100	100	0	0	50	60	90	0	0	0	10	20	0
SURVIVAL-96	%	0	100	80	0	0	40	0	90	0	0	0	10	0	0
TOXICITY	UNITS	1.61	0.00	0.77	1.64	1.54	1.04	1.20	0.59	2.86	1.16	1.64	1.14	1.16	1.28

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NORTHPOINT STP - INFLUENT ANALYSIS - BIOASSAYS

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
TLM-24 HR	%	92	35	79
TLM-48 HR	%	90	10	65
TLM-96 HR	%	96	35	82
SURVIVAL-24	%	100	0	41
SURVIVAL-48	%	100	0	36
SURVIVAL-96	%	100	0	34
TOXICITY	UNITS	2.86	0.00	0.98

NORTHPOINT STP - INFLUENT ANALYSIS - RADIOACTIVE SUBSTANCES - 1973

		MON 4/16		TUES 4/24		WED 4/18		THUR 4/26		FRI 4/20		SAT 4/28		SUN 4/22	
CONSTITUENT	UNIT	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP
GROSS ALPHA	PC/L I	3	25 I	4	26 I	4	9 I	17	28 I	5	11 I	6	10 I	5	7 I
GROSS BETA	PC/L I	19	28 I	19	46 I	18	32 I	21	32 I	19	42 I	23	36 I	16	28 I
RADIUM 226	PC/L I	0.70	0.10 I	0.14	0.10 I	0.08	0.03 I	0.20	0.11 I	0.04	0.10 I	0.10	0.10 I	0.10	0.12 I
STRONT. 90	PC/L I	0.5	2.0 I	0.5	0.5 I	1.0	1.0 I	0.5	0.5 I	0.5	0.5 I	0.5	0.5 I	0.5	0.5 I

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NORTHPOINT STP - INFLUENT ANALYSIS - RADIOACTIVE SUBSTANCES

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
GROSS ALPHA	PC/L	28	3	17
GROSS BETA	PC/L	46	16	35
RADIUM 226	PC/L	0.70	0.03	0.09
STRONT. 90	PC/L	2.0	0.5	0.8

NORTHPOINT STP INFLUENT ANALYSIS - CHLORINATED HYDROCARBONS - 1973

		MON 4/16		TUES 4/24		WED 4/18		THUR 4/26		FRI 4/20		SAT 4/28		SUN 4/22	
CONSTITUENT	UNIT	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP	GRAB	COMP
LINDANE	UG/L	0.004	0.002	0.001	0.009	0.017	0.009	0.074	0.001	0.018	0.025	0.021	0.100	0.047	0.037
HPT-CL-EPOX	UG/L	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.002	0.001	0.001	0.001	0.002	0.039	0.001
DDE	UG/L	0.002	0.002	0.001	0.021	0.015	0.011	0.011	0.018	0.009	0.011	0.012	0.006	0.001	0.001
DDD	UG/L	0.001	0.001	0.001	0.001	0.009	0.011	0.001	0.001	0.091	0.010	0.016	0.009	0.041	0.021
DDT	UG/L	0.013	0.008	0.001	0.001	0.104	0.050	0.080	0.067	0.047	0.064	0.080	0.038	0.055	0.067
DIELDRIN	UG/L	0.002	0.002	0.024	0.001	0.012	0.012	0.001	0.001	0.001	0.001	0.001	0.001	0.022	0.001
TOT CL H.C.	UG/L	0.651	0.770	0.495	0.641	1.045	0.800	0.061	0.704	0.952	1.270	0.407	0.219	1.090	0.783
ALDRIN	UG/L	0.001	0.001	0.001	0.009	0.035	0.022	0.001	0.001	0.011	0.008	0.001	0.001	0.001	0.001
CHLORDANE	UG/L	0.020	0.001	0.001	0.066	0.161	0.058	0.001	0.001	0.021	0.034	0.001	0.010	0.156	0.001
ENDRIN	UG/L	0.002	0.001	0.011	0.002	0.011	0.001	0.003	0.006	0.001	0.001	0.006	0.003	0.001	0.001
HEPTACHLOR	UG/L	0.001	0.200	0.020	0.001	0.045	0.001	0.006	0.019	0.029	0.001	0.001	0.001	0.047	0.031
METHOXYCHLO	UG/L	0.001	0.001	0.001	0.261	0.001	0.004	0.001	0.015	0.002	0.010	0.003	0.001	0.001	0.008
TOXAPHENE	UG/L	0.005	0.001	0.001	0.001	0.030	0.001	0.080	0.020	0.010	0.014	0.008	0.001	0.001	0.001
ORG PHOSPH	UG/L	7.306	7.600	1.362	0.085	0.437	0.515	2.087	0.012	0.480	0.913	0.716	0.279	0.592	0.151
2-4-D	UG/L	0.425	0.286	0.225	0.412	1.241	0.799	0.692	0.350	0.465	0.401	0.681	0.175	0.212	0.794
PCB	UG/L	0.304	0.433	0.334	0.195	0.550	0.566	0.021	0.097	0.028	0.662	0.101	0.067	1.072	0.916
CARBAMATES	UG/L	0.016	0.001	0.111	0.012	0.015	0.012	0.561	0.341	0.031	0.015	0.019	0.001	0.190	0.071

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NORTHPOINT STP INFLUENT ANALYSIS - CHLORINATED HYDROCARBONS

CONSTITUENT	UNIT	HIGH	LOW	AVG COMP
LINDANE	UG/L	0.100	0.001	0.026
HPT-CL-EPOX	UG/L	0.039	0.001	0.001
DDE	UG/L	0.021	0.001	0.010
DDD	UG/L	0.091	0.001	0.008
DDT	UG/L	0.104	0.001	0.042
DIELDRIN	UG/L	0.024	0.001	0.003
TOT CL H.C.	UG/L	1.270	0.061	0.741
ALDRIN	UG/L	0.035	0.001	0.006
CHLORDANE	UG/L	0.161	0.001	0.024
ENDRIN	UG/L	0.011	0.001	0.002
HEPTACHLOR	UG/L	0.200	0.001	0.036
METHOXYCHLO	UG/L	0.261	0.001	0.043
TOXAPHENE	UG/L	0.080	0.001	0.006
ORG PHOSPH	UG/L	7.600	0.012	1.365
2-4-D	UG/L	1.241	0.175	0.460
PCB	UG/L	1.072	0.021	0.419
CARBAMATES	UG/L	0.561	0.001	0.065

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Appendix D

WATER QUALITY STRATEGY PAPER

Second Edition

Environmental
Protection Agency
Region 9

DEC 22 1977

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A

STATEMENT OF POLICY
FOR IMPLEMENTING THE REQUIREMENTS
OF THE
1972 FEDERAL WATER POLLUTION CONTROL ACT
AMENDMENTS

AND CERTAIN REQUIREMENTS
OF THE
1972 MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

U.S. ENVIRONMENTAL PROTECTION AGENCY
Washington, D.C. 20460

March 15, 1974

CONTENTS

APPENDIX

The Appendix is being printed and distributed separately. Individual addressees will receive a copy when available.

Near term Federal operations and maintenance inspections should be conducted to assist the establishment of permit conditions and improve the operational efficiency of major plants and smaller plants in critical areas of water pollution. Intensive technical assistance to selected problem plants should be provided to demonstrate the improvement possible from good O&M. Regions will work closely with the States in these efforts to develop the State O&M programs as rapidly as possible.

Manpower Training

The number of trained operator personnel needs to be increased and their skills improved if the permit requirements are to be met. To help in developing a supply of these personnel, EPA will assist local areas in assessing their manpower needs and will compile a nationwide forecast. EPA has developed model training curricula and will assist the States in adjusting them to their own needs. State training programs will be further assisted by EPA grants intended to train entry-level personnel and to upgrade present employees' skills. Under the Act, EPA can provide each State a 100% grant of up to $250,000 to construct a training facility in the State for the training of operators and maintenance personnel.

C.2. Combined Sewer Overflows and Stormwater Discharges

Strategic Guidance

As a class of point source discharges, the overflows from a municipal waste collection and treatment system and discharges from sewers which collect stormwater can be shown to have a major impact on water quality. However control of these sources faces the following problems. While legislative history to the Act contains frequent references to the need for control, neither the history nor the Act itself indicates definitively whether these sources must be subject to an effluent standard in addition to water quality standards; and if the former, what kind of effluent standards should be applied--those for publicly owned treatment works, or those for sources other than publicly owned treatment works. Again, the effects of overflows and stormwater discharges have historically received little study. Little monitoring is performed during storm conditions, either on loadings or effects. This was most recently demonstrated by the Needs Survey, in which some States presented partial data on the control of overflows, but others had none at all. Finally, overflows and stormwater discharges exhibit a characteristically uneven pollutant load as between the first hour or two of discharge, subsequent flows, and the final tapering load. This, plus the fact that the ratio between dry and wet weather flow frequency varies radically between basins and regions, presents difficulties in the establishment of an effluent standard. Unlike secondary treatment for treatment plants, there is not a generally recognized acceptable level of treatment for overflows and stormwater discharges. The following strategy flows from the above considerations.

Overflows and storm sewers will not be considered publicly owned treatment works for the purpose of complying with the effluent standards of secondary treatment for 1977 (Titles III and IV); nor will a separate uniform effluent standard be promulgated for them. Correction of overflow problems will be defined in terms of meeting the applicable water quality standards of 1977 and the fishable/swimmable standards of 1983. "Meeting water quality standards" is itself a concept which will be further defined in guidance by EPA.

It would generally be expected that the degree and extent of treatment of wet weather flows would correspond only to what is required to achieve standards. In this case, not all overflow or stormwater pipes in a geographic area need receive treatment, and the treatment levels on those that do could vary.

Overflows will be precisely defined to distinguish between storm-caused overflows and overflows resulting from structural defects in the municipal waste system, e.g., inadequate treatment capacity or excessive infiltration. Dry weather overflows which result from such conditions will be subject to the full requirements of secondary treatment.

BPWTT is assigned as the 1983 effluent standard for a municipal treatment plant, as distinct from a treatment system. This standard is presently defined as secondary treatment for direct dischargers. Satisfaction of the 1983 water quality requirements may dictate that a community introduce advanced treatment of its discharge, or begin using land disposal or a reuse system. An alternative to this may result from an examination of the entire system as opposed to just the treatment plant. Provision can be made for controls on overflows in place of added or optimum treatment at the plant where this would make more sense in terms of local water quality conditions (a coliform vs. a dissolved oxygen problem for example). This flexibility clause is the present device for incorporating overflows and stormwater within the 1983 permit effluent goals. EPA will hold in abeyance the alternative of setting a separate, uniform effluent standard for overflows.

An additional consideration in examining the need for correction of wet weather flows results from correlating the water use to be protected (as an example, swimming) with the season and frequency that rainfall occurs. If swimming activities only occur during a season when there is little or no rainfall, correction of wet weather flows may be unwarranted.

Where overflow conditions have been studied and overflow needs are presently known, treatment of overflows can be given comparable eligibility with treatment plant construction in terms of access to Federal funding under Title II. States are thus at liberty to handle acute overflow problems on a case-by-case basis, but will not be required to provide correction of all problems by 1977. Consistent with this strategy, overflow needs, which have been only fragmentarily reported in the Needs

Survey, were not used as a basis for apportionment of Federal construction grant funds among States for FY75. However, the Needs Survey to be conducted in 1974 will more fully examine needs in this area.

Where wet weather conditions have not been studied and needs have not been assessed, the NPDES permit program will become the vehicle to produce such analysis. Permits will require municipalities to monitor overflows, and, within 1-2 years, develop a plan for their correction to meet water quality standards. All overflows from municipal waste systems will thus be permitted, and, where the requisite planning has been done, become eligible for inclusion on State project lists. It is expected that facilities plans (Step 1 grants) and areawide plans under §208 will be used to prepare corrective solutions for combined and storm sewer flows.

D. PROGRAM MANAGEMENT

D.1. Planning and Program Management

Effective water quality management involves an assessment of the situation; developing a plan for control of existing or potential problems; an orderly implementation of the plan; followed by a system for review and reporting. Under the Act, the States and areawide agencies at their level are responsible for the development of management programs integrating and carrying out these components. EPA contributes guidance, technical assistance and financial support.

The management program is oriented toward two phases: Phase I aimed at achieving the Act's 1977 objectives and Phase II for the 1983 goals.

To achieve the Act's 1977 objectives, the initial management effort must focus on point source controls, such as permits and construction grant awards. To support these activities, planning must prepare waste load analyses in water quality segments, and provide the management information to assist in coordinating and directing various program efforts.

Longer range management, Phase II, will address additional and often more complex problems, including non-point source control. It will be supported by more extensive water quality and technical information and will employ a more sophisticated planning structure, including evaluation of past efforts, to produce more comprehensive State strategies and programs. Areawide waste treatment management will be introduced.

The principal statutory water quality management mechanisms are:

- Basin management. The State prepares a segment-based, water quality oriented analysis and plan for an overall basin. The annual State program will be developed largely from these plans.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 1 6 1975

PROGRAM REQUIREMENTS MEMORANDUM PRM NO. 75-34
Program Guidance Memorandum PG-61

SUBJECT: Grants for Treatment and Control of Combined Sewer Overflows and Stormwater Discharges

FROM: John T. Rhett, Deputy Assistant Administrator for Water Program Operations (WH-546) John T. Rhett

TO: Regional Administrators
Regions I - X

This memorandum summarizes the Agency's policy on the use of construction grants for treatment and control of combined sewer overflows and stormwater discharges during wet-weather conditions. The purpose is to assure that projects are funded only when careful planning has demonstrated they are cost-effective.

I. Combined Sewer Overflows

A. Background

The costs and benefits of control of various portions of pollution due to combined sewer overflows and by-passes vary greatly with the characteristics of the sewer and treatment system, the duration, intensity, frequency and areal extent of precipitation, the type and extent of development in the service area, and the characteristics, uses and water quality standards of the receiving waters. Decisions on grants for control of combined sewer overflows, therefore, must be made on a case-by-case basis after detailed planning at the local level.

Where detailed planning has been completed, treatment or control of pollution from wet-weather overflows and bypasses may be given priority for construction grant funds only after provision has been made for secondary treatment of dry-weather flows in the area. The detailed planning requirements and criteria for project approval follow.

B. Planning Requirements

Construction grants may be approved for control of pollution from combined sewer overflows only if planning for the project has thoroughly analyzed for the 20 year planning period:

1. Alternative control techniques which might be utilized to attain various levels of pollution control (related to alternative beneficial uses, if appropriate), including at least initial consideration of all the alternatives described in the section on combined sewer and stormwater control in "Alternative Waste Management Techniques and Best Practicable Waste Treatment" (Section C of Chapter III of the information proposed for comment in March 1974).

2. The costs of achieving the various levels of pollution control by each of the techniques appearing to be the most feasible and cost-effective after the preliminary analysis.

3. The benefits to the receiving waters of a range of levels of pollution control during wet-weather conditions. This analysis will normally be conducted as part of State water quality management planning, 208 areawide management planning, or other State, regional or local planning effort.

4. The costs and benefits of addition of advanced waste treatment processes to dry-weather flows in the area.

C. Criteria for Project Approval

The final alternative selected shall meet the following criteria:

1. The analysis required above has demonstrated that the level of pollution control provided will be necessary to protect a beneficial use of the receiving water even after technology based standards required by Section 301 of P.L. 92-500 are achieved by industrial point sources and at least secondary treatment is achieved for dry-weather municipal flows in the area.

2. Provision has already been made for funding of secondary treatment of dry-weather flows in the area.

3. The pollution control technique proposed for combined sewer overflow is a more cost-effective means of protecting the beneficial use of the receiving waters than other combined sewer pollution control techniques and the addition of treatment higher than secondary treatment for dry-weather municipal flows in the area.

4. The marginal costs are not substantial compared to marginal benefits.

Marginal costs and benefits for each alternative may be displayed graphically to assist with determining a project's acceptability under this criterion. Dollar costs should be compared with quantified pollution reduction and water quality improvements. A descriptive narrative should also be included analyzing monetary, social and environmental costs compared to benefits, particularly the significance of the beneficial uses to be protected by the project.

II. Stormwater Discharges

Approaches for reducing pollution from separate stormwater discharges are now in the early stages of development and evaluation. We anticipate, however, that in many cases the benefits obtained by construction of treatment works for this purpose will be small compared with the costs, and other techniques of control and prevention will be more cost-effective. The policy of the Agency is, therefore, that construction grants shall not be used for construction of treatment works to control pollution from separate discharges of stormwater except under unusual conditions where the project clearly has been demonstrated to meet the planning requirements and criteria described above for combined sewer overflows.

III. Multi-purpose Projects

Projects with multiple purposes, such as flood control and recreation in addition to pollution control, may be eligible for an amount not to exceed the cost of the most cost-effective single purpose pollution abatement system. Normally the Separable Costs-Remaining Benefits (SCRB) method should be used to allocate costs between pollution control and other purposes, although in unusual cases another method may be appropriate. For such cost allocation, the cost of the least cost pollution abatement alternative may be used as a substitute measure of the benefits for that purpose. The method is described in "Proposed Practices for Economic Analysis of River Basin Projects," GPO, Washington, D. C., 1958, and "Efficiency in Government through Systems Analysis," by Roland N. McKean, John Wiley & Sons, Inc., 1958.

Enlargement of or otherwise adding to combined sewer conveyance systems is one means of reducing or eliminating flooding caused by wet-weather conditions. These additions may be designed so as to produce some benefits in terms of reduced discharge of pollutants to surrounding waterways. The pollution control benefits of such flood control measures, however, are likely to be small compared with the costs, and the measures therefore would normally be ineligible for funding under the construction grants program.

All multi-purpose projects where less than 100% of the costs are eligible for construction grants under this policy shall contain a special grant condition precluding EPA funding of non-pollution control elements. This condition should, as a minimum, contain a provision similar to the following:

> "The grantee explicitly acknowledges and agrees that costs are allowable only to the extent they are incurred for the water pollution control elements of this project."

Additional special conditions should be included as appropriate to assure that the grantee clearly understands which elements of the project are eligible for construction grants under Public Law 92-500.

APPENDIX E

DRAFT

WWP - SUMMARY OF SHELLFISH COLIFORM TEST RESULTS

DATE TIME	SAMPLING LOCATION	WATER (MPN/100 ml) TOTAL	FECAL	FECAL STREPT	SEDIMENTS (MPN/100 gm) TOTAL	FECAL	SHELLFISH TISSUE (MPN/100 gm) SPECIES	TOTAL	FECAL	PLATE COUNT/gm	REMARKS*
6/20/78	Brisbane Lagoon	--	--	--	--	--	NR	70,000	1,100	3,600	SMCo
7/18/78	Brisbane Lagoon	15	4	--	--	--	NR	490	70	10,000	SMCo
7/19/78 10 AM	Candlestick Cove 500' NE of Sunnydale Outfall	<18 <18 <18	20 <18 18	--	--	--	Mya Tapes	3,300 11,000	2,300 11,000	7,600 5,000	
8/3/78 10 AM	West Side Brisbane Lagoon Rocky Point	< 2 < 2 < 2	<2 <2 <2	--	20 50 80	<20 <20 <20	Tapes	330	20	5,500	
8/3/78 11 AM	Candlestick Cove 500' of Sunnydale Outfall	46 920 >2,400	23 2 23	--	1,700 3,500 5,400	790 490 1,100	Tapes	790	80	1,300	
8/3/78 9 AM	North Side Brisbane Lagoon 1000' W/NE	350 110 350	240 79 350	--	230 20 5,400	80 <20 2,200	Tapes	2,400	330	1,100	Smoldering fire on beach over night camping?? Also, down-current of bird feeding area
8/3/78 8 AM	East Side Brisbane Lagoon 100' South of Culverts	2 < 2 < 2	2 <2 <2	--	460 50 <20	90 20 < 20	Mya Tapes	130 490	< 20 80	500 340	
8/8/78	Brisbane Lagoon	2,400	1,100	--	--	--	NR	11,000	5,400	7,000	SMCo

* SMCO = Samples collected & analyzed by San Mateo County Dept. of Public Health

NR = Not Reported

WWP - SUMMARY OF SHELLFISH COLIFORM TEST RESULTS

DATE TIME	SAMPLING LOCATION	WATER (MPN/100 ml) TOTAL	FECAL	FECAL STREPT	SEDIMENTS (MPN/100 gm) TOTAL	FECAL	SHELLFISH TISSUE SPECIES	(MPN/100 gm) TOTAL	FECAL	PLATE COUNT/gm	REMARKS*
8/9/78 10:30 A	Southside of Candlestick Point at Isthmus	5 2 <2	5 2 <2	---	40 230	20 130	Tapes	1,700	460	820	
8/9/78 11:15 A	N. Side Yosemite Channel 100' E/Griffith St. Outfall	540 350 350	13 11 33	Channel Tide Pools	---	---	90% Mya 10% Tapes	>24,000	>24,000	1,100,000	
8/21/78 10:30 A	India Basin-Dirt Boat Launch Ramp-500' SE of PG&E Plant	92 220 350	130 46 49	---	3,500 ≥24,000	<20 130	Tapes	270	20	1,200	
8/21/78 10:00 A	Warm Water Cove - SE End of Rocky Beach	110 110 170 49	<2 <2 5 2	---	1,400 2,400	<20 50	Tapes	3,500	130	34,000	
8/23/78 10:00 A	Candlestick Causeway-1800' South of Brisbane Lagoon Culverts	<2 <2 2	<2 <2 2	---	80 20	<20 <20	Tapes & Mya	220	50	580	
8/23/78 11:30 A	Candlestick Point-North Side of Isthmus	49 31 49	49 31 49	---	330 1,300	70 220	Tapes	230	20	720	
8/28/78 10:30 A	Candlestick Causeway-1600' North of Brisbane Lagoon Culverts	2 13 5	2 13 5	---	330 130	50 20	Mya & Tapes	790	80	380	
8/30/78 8:00 A	Westside of Brisbane Lagoon	23 13	23 13	8	20 790	20 490	95% Tapes 5% Mya	790	330	7,400	Complt'd Fecal = 23 E. Coli (IMVic)= 23 Complt'd Fecal = 13 E. Coli (IMVic) = 2

* SMCO = Samples collected & analyzed by San Mateo County Dept. of Public Health

WWP - SUMMARY OF SHELLFISH COLIFORM TEST RESULTS

DATE / TIME	SAMPLING LOCATION	WATER (MPN/100 ml) TOTAL	WATER FECAL	WATER FECAL STREPT	SEDIMENTS (MPN/100 gm) TOTAL	SEDIMENTS FECAL	SHELLFISH TISSUE SPECIES	SHELLFISH TISSUE (MPN/100 gm) TOTAL	SHELLFISH TISSUE FECAL	PLATE COUNT/gm	REMARKS*
8/30/78 8:30A	Brisbane Lagoon - North	49 33	33 33		230 310	230 20	Mya & Tapes	700	330	990	
8/30/78 9:15A	Brisbane Lagoon - Eastshore	2 23	2 23	5	490 1,700	490 1,700	Mya & Tapes	1,300	790	520	
9/6/78 9:15A	Candlestick Cove - (County Line)	≥2,400 920	49 17	--	9,200 3,500	1,700 700	Tapes	3,500	490	480	Complt'd Fecal=49 E.Coli(IMVic) =49 Complt'd Fecal=17 E.Coli(IMVic)=17
9/6/78 10:00A	Candlestick Point - South Side	79 33	17 13	8 14	790 2,500	20 50	NR**	490	80	880	
10/4/78	India Basin Dirt Ramp S. of PG & E	350 -- -- 1,600	170 22 33 140	--	≥24,000 9,200	1,700 3,500	NR	5,400	3,500	8,200	
10/4/78	Yosemite Channel 200' E. of Griffith	≥2,400 -- ≥2,400	13 94 17 17	--	≥24,000 ≥24,000	3,500 490	NR	54,000	270	13,000	
10/17/78 10:30A	Candlestick Point - South Side	≥2,400 920	≥2,400 920	7 7	310 2,200	170 110	Not Collected Tide Too High				
10/17/78	Candlestick Point - North Side	11	11	<3	130 330	50 330	Not Collected Tide Too High				

NR = Not Reported

WWP - SUMMARY OF SHELLFISH COLIFORM. TEST RESULTS

DATE TIME	SAMPLING LOCATION	WATER (MPN/100 ml) TOTAL	FECAL	FECAL STREPT	SEDIMENTS (MPN/100 gm) TOTAL	FECAL	SHELLFISH TISSUE (MPN/100 gm) SPECIES	TOTAL	FECAL	PLATE COUNT/gm	REMARKS*
10/17/78 9:30 A	Sunnydale Outfall N. End of Causeway	5 5	<2 2	2 2	490 2,400	40 2,400	NR	490	230	540	
10/18/78 9:30 A	Candlestick Causeway 1200' S of Brisbane Culvert	13 17	8 7	---	20 210	<20 20	NR	Not collected. Tide too high.			Compltd Fecal=8 E.Coli(IMVic)=8 Compltd Fecal=7 E.Coli(IMVic)=7
10/18/78 10:00 A	Candlestick Causeway 800' N Brisbane Culvert	22 5	4 2	---	70 50	<20 <20	Tapes	490	50	460	Compltd Fecal=2 E.Coli(IMVic)=2 Complt'd Fecal=2 E.Coli(IMVic)=2
10/18/78 10:30 A	India Basin Evans Outfall Boat Launch Ramp	920 920	350 240	(i) 17	2,400 1,300	330 460		Not collected. Tide too high.			(i) Insufficient sample. Appears to have some present.
11/1/78 08:45 A	Brisbane Lagoon - East Shore 300' S. of Culvert	5	<2	<2	<20	<20	Tapes & Mya	790	20	3,000	
11/1/78 08:45 A	Brisbane Lagoon - East Shore 400' S. of Culvert	11	<2 <2	---	50	<20		Not collected. Tide too high.			
11/1/78 09:45 A	Brisbane Lagoon - W. Midshore	5 130	2 22	---	490	50 60	Tapes & Mya	110	20	4,800	Compltd Fecal = 2 E.Coli(IMVic) = 2 Complt'd Fecal = 22 E. Coli (IMVic)=22
11/1/78 09:30A	Brisbane Lagoon - N. Shore - Dirt Ramp	130 8	33 2	---	130 790	50 20		Not collected. Tide too high.			Complt'd Fecal =33 E.Coli(IMVic) =33 Complt'd Fecal =2 E. Coli (IMVic)=2

* SMCO = Samples collected & analyzed by San Mateo County Dept. of Public Health

NR = Not Reported

WWP - SUMMARY OF SHELLFISH COLIFORM TEST RESULTS

DATE TIME	SAMPLING LOCATION	WATER (MPN/100 ml) TOTAL	WATER FECAL	WATER FECAL STREPT	SEDIMENTS (MPN/100 gm) TOTAL	SEDIMENTS FECAL	SHELLFISH TISSUE SPECIES	SHELLFISH TISSUE (MPN/100 gm) TOTAL	SHELLFISH TISSUE (MPN/100 gm) FECAL	PLATE COUNT/gm	REMARKS*
2/21/79 2:30 P	Yosemite	---	---	---	---	---	Tapes	---	92,000	310,000	
2/21/79 3:00 P	Candlestick Cove	---	---	---	---	---	Tapes	---	≥240,000	770,000	
2/21/79 3:00 P	South Causeway	---	---	---	---	---	Tapes	---	5,400	10,000	
2/21/79 3:00 P	North Causeway	---	---	---	---	---	Tapes	---	1,700	13,000	
2/21/79 3:30 P	North Brisbane Lagoon	---	---	---	---	---	Tapes	---	9,200	37,000	
2/21/79	West Brisbane Lagoon	---	---	---	---	---	Tapes	---	2,400	16,000	
3/6/79	Yosemite Creek	---	---	---	---	---	NR	---	9,200	17,000	
3/6/79 12:30 P	Warmwater Cove	---	---	---	---	---	NR	---	790	26,000	

* SMCO = Samples collected & analyzed by San Mateo County Dept. of Public Health

NR = Not Reported

E-6

WWP - SUMMARY OF SHELLFISH COLIFORM TEST RESULTS

DATE TIME	SAMPLING LOCATION	WATER (MPN/100 ml)			SEDIMENTS (MPN/100 gm)		SHELLFISH TISSUE (MPN/100 gm)			PLATE COUNT/gm	REMARKS*
		TOTAL	FECAL	FECAL STREPT	TOTAL	FECAL	SPECIES	TOTAL	FECAL		
3/6/79 2:30 P	Candlestick Cove	---	---	---	---	---	NR	---	490	17,000	
3/6/79 3:30 P	Causeway - North	---	---	---	---	---	NR	--	310	27,000	
3/6/79 18:30 P	Candlestick Point	---	---	---	---	---	NR	----	9,200	26,000	
4/2/79	Candlestick Cove	---	---	---	---	---	Tapes	92,000	92,000	14,000	
4/2/79	Brisbane Lagoon - West	---	---	---	---	---	Tapes	2,400	490	1,400	
4/2/79	Candlestick Point	---	---	---	---	---	Tapes	1,100	330	4,300	
4/2/79	Brisbane Lagoon-North	---	---	---	---	---	Tapes	7,000	330	5,200	
4/2/79	Yosemite	---	---	---	---	---	Tapes	92,000	5,400	17,000	

* SMCO = Samples collected & analyzed by San Mateo County Dept. of Public Health

NR = Not Reported

WWP - SUMMARY OF SHELLFISH COLIFORM. TEST RESULTS

DATE TIME	SAMPLING LOCATION	WATER (MPN/100 ml) TOTAL	WATER (MPN/100 ml) FECAL	WATER (MPN/100 ml) FECAL STREPT	SEDIMENTS (MPN/100 gm) TOTAL	SEDIMENTS (MPN/100 gm) FECAL	SHELLFISH TISSUE SPECIES	SHELLFISH TISSUE (MPN/100 gm) TOTAL	SHELLFISH TISSUE (MPN/100 gm) FECAL	PLATE COUNT/gm	REMARKS*
4/2/79	Warmwater Cove	---	---	---	---	---	NR	9,200	170	8,500	
4//279	North Causeway	---	---	---	---	---	Tapes	9,200	490	1,000	

* SMCO = Samples collected & analyzed by San Mateo County Dept. of Public Health

NR = Not Reported

RBM

Parsons
Brinckerhoff

PBQ&D, Inc. Engineers • Architects • Planners

April 3, 1979

CH2M-Hill, Inc.
450 Sansome Street
San Francisco, CA 94111

Attention: Mr. Richard Meighan

Subject: Bay Overflow Outfalls Feasibility (Preconceptual) Level Construction Cost Estimates

Gentlemen:

In accordance with the provisions of our Contract with you dated 23 March 1979, we are enclosing the Contraction Cost Estimates for eight (8) Overflow Outfalls in four (4) designated locations. These estimates are based on the following data:

1. Four (4) Bay Predesign Aquatic Study prints showing site plans and bay bottom profiles furnished to us by you on March 26, 1979. We used these prints as background for our layouts of the proposed outfalls including plans, profiles and cross sections of the outfall pipes and diffuser risers and ports.

2. Table 2 titled, "Characteristics of Bay Outfall Alternatives" also furnished to us by you on March 26, 1979. As directed by you, we prepared layouts and cost estimates for outfalls in the following locations:

   - o Location 1A - Channel Street
   - o Location 2A - Islais Creek
   - o Location 3A - Yosemite
   - o Location 4A - North Point

As directed, we prepared layouts and cost estimates for two outfalls in each location - one for a gravity system and the other for a pumping system. All outfalls were based on an initial dilution requirement of 10:1 only.

The Construction Cost Estimates enclosed were prepared under great constraints of time and budget, and, therefore, should be considered as having attained only a feasibility (or preconceptual) level of accuracy. They are further subject to the following qualifications:

1. Costs were based on March 1979 dollar value. They were not escalated for future inflation, and therefore do not reflect the actual cost of labor, materials and equipment at the future time of construction.

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Parsons Brinckerhoff

Mr. Richard Meighan
April 3, 1979
Page Two

2. Costs do not include the expense of site investigation, engineering, contract administration, inspection, construction management, permits, financing and legal fees.

3. Interference, if any, with existing structures and pipelines was not considered.

4. Interface with onshore facilities were not included. Cofferdams, sheet piling, etc. associated with the headworks and transition structures were assumed to be done by others.

5. Excavation quantities were based on 2½:1 side slopes in sand at North Point and on 1½:1 side slopes in bay mud elsewhere. Disposal was assumed to be by barge dumping at an approved site near Alcatraz Island.

6. Redredging, overdredging and extra dredging were allowed for by factoring theoretical quantities.

7. Pipe was assumed to be reinforced concrete with a maximum section length of 24' and not exceeding 100 tons in weight per section.

8. All pipe was assumed to be placed from a crane barge with the rate of installation based on considerations of weight and size of sections, depth of water and interference with ship traffic.

SUMMARY OF ESTIMATED COST OF CONSTRUCTION

Location	Type	Pipe Size	Outfall Length	Estimated Cost of Construction
1A-Channel St.	Gravity	2 - 18'Ø	7460 ft.	$44.1 million
1A-Channel St.	Pumping	1 - 17'Ø	8920 ft.	$27.3 million
2A-Islais Creek	Gravity	2 - 17'Ø	2800 ft.	$19.1 million
2A-Islais Creek	Pumping	1 - 16'Ø	4200 ft.	$12.4 million
3A-Yosemite	Gravity	1 - 11'-3"Ø	6060 ft.	$12.8 million
3A-Yosemite	Pumping	1 - 8'-0"Ø	6060 ft.	$ 9.1 million
4A-North Point	Gravity	1 - 8'-9"Ø	1760 ft.	$ 3.6 million
4A-North Point	Pumping	1 - 6'-3"Ø	1760 ft.	$ 3.0 million

This, we believe, fulfills our March 23, 1979 contract with you in full.

Should you have any comments or questions, please do not hesitate to call or write.

Very truly yours,

P B Q & D, Inc.

CH2M HILL

SUBJECT Bay Outfall Cost Summary

BY RBM DATE 6 April 79

SHEET NO. 1 OF 1

PROJECT NO. EM460.H0

Alternative	System	Dilution	Cost Million $
1	Gravity	10:1	44.1
1	Pumping	10:1	27.3
1	Gravity	5:1	39.3
1	Pumping	5:1	22.7
2	Gravity	10:1	19.1
2	Pumping	10:1	12.4
2	Gravity	5:1	14.9
2	Pumping	5:1	9.4
3	Gravity	10:1	12.8
3	Pumping	10:1	9.1
3	Gravity	5:1	11.8
3	Pumping	5:1	9.1
4	Gravity	10:1	3.6
4	Pumping	10:1	3.0
4	Gravity	5:1	3.2
4	Pumping	5:1	2.7

APPENDIX G

OFFICE OF
CHIEF ADMINISTRATIVE OFFICER

MAY 4 1979

ROGER BOAS
CHIEF ADMINISTRATIVE OFFICER

289 CITY HALL
SAN FRANCISCO
CALIFORNIA 94102
415/558-4851

May 2, 1979

Storm Water Overflows Control
and Beach Posting Program

1.6.3

Mervyn Silverman, M.D., M.P.H.
Director of Health
101 Grove Street
San Francisco, CA 94102

Dear Dr. Silverman:

As you know, the San Francisco Wastewater Program is negotiating with the San Francisco Regional Water Quality Control Board in an attempt to increase the number of allowable overflows for our sewerage system. We have been doing this because of the extremely high cost of implementing the strict control level that was ordered for the City. Your Department has been extremely helpful in our case, especially the work of Dr. Braff, Dr. Dritz, and the lab staff. Though we have been successful in achieving a more cost-effective level of overflow control for the Ocean Beach and North Shore areas, we must still be cognizant of the fact that some overflows will occur and there may be some public health risk, even though your voluminous records do not indicate any correlation of enteric disease caused by the storm water overflows.

In performing your function as the guardian of public health, I believe that you should continue your program of posting warning signs on all beaches and shellfish harvesting areas affected by wet weather overflows. The areas of special concern are Ocean Beach, the North Shore area, including Aquatic Park and Marina Green, Warm Water Cove, Yosemite Canal, Candlestick Peninsula, and the Candlestick Causeway. These areas should be posted for a period of time, commencing with the day of overflow, until the water analysis indicates that the water quality of the affected areas is meeting bacteriological standards for water contact sports recreation. Since the waters of the Bay and ocean are continuously in motion, you should also coordinate with Health Department officials in San Mateo County and the State Department of Health Services to devise an acceptable and compatible program which will address our concerns.

During our studies related to establishing the new levels of overflow control, we have noticed that a small number of individuals are harvesting clams from the Bay waters. Ycur lab analysis has indicated that some of these clams have high levels of coliform bacteria. It may be advisable for you to develop an information program and literature explaining what must be done with the clams to make them acceptable for human consumption.

In order that we obtain realistic information for future evaluation of our system, would you please keep a record of the days that any area is posted and transmit it to the Wastewater Program, 770 Golden Gate Avenue. It also would be helpful if those doing the posting would note the various beach usage activities that they observe.

Thank you for your cooperation.

Very truly yours,

Roger Boas

Roger Boas
Chief Administrative Officer
City and County of San Francisco